Final Draft

East Lake Sammamish Master Plan Trail Wetland Biology Discipline Report

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
BMPs	best management practices
BNSF	Burlington-Northern/Santa Fe Railroad
CAG	Citizens Advisory Group
DNR	Department of Natural Resources
EA	Environmental Assessment
ELSMPT	East Lake Sammamish Master Plan Trail
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
FAC	facultative plants
FACU	facultative upland plants
FACW	facultative wetland plants
FHWA	Federal Highway Administration
FONSI	finding of no significant impacts
GMA	State Growth Management Act
HGM	hydrogeomorphic
HPA	Hydraulic Project Approval
I-90	Interstate 90
KCDDES	King County Department of Development and Environmental Services
KCDPR	King County Division of Parks and Recreation
mph	miles per hour
NEPA	National Environmental Policy Act
NI	not indicated
NL	not listed
NRCS	National Resources Conservation Service
NWI	National Wetlands Inventory
OBL	obligate wetland plants
SEPA	State Environmental Policy Act
SMA	State Shoreline Management Act
SR	State Route
UGB	Urban Growth Boundary
UPL	obligate upland plants
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

King County is proposing to develop the East Lake Sammamish Master Plan Trail (Master Plan Trail), a regional multi-user trail and non-motorized, alternative transportation corridor located near the eastern shore of Lake Sammamish in Issaquah, Sammamish, and Redmond, Washington. King County is evaluating the potential environmental impacts of the Master Plan Trail through a combined State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) process. King County is the SEPA lead agency. The Federal Highway Administration (FHWA), with local assistance from the Washington State Department of Transportation (WSDOT), is the NEPA lead agency.

This wetland biology discipline report is intended to provide information in support of the EIS process and project planning and permitting. It meets the WSDOT Environmental Procedures Manual (WSDOT 2003) requirements for a wetland biology discipline report and conceptual mitigation plan. This report describes potential impacts caused by the proposed project to wetland and wetland buffer area and functions and describes efforts to mitigate these impacts and compensate for unavoidable impacts. Information regarding the proposed project, its purpose and need, and its historical context is provided.

The following is background information regarding the planning and implementation of the project, relative to wetlands:

1. In 1999, King County developed a plan to implement the trail in phases: (1) an interim phase in which the railbanked right-of-way would be open to public use through 2015 and measures would be established to protect natural resources along the right-of-way; (2) a Master Plan phase in which a permanent, alternative transportation corridor and multi-use recreational trail would be designed and constructed.

2. The East Lake Sammamish Interim Use Trail (Interim Use Trail) is an 8- to 12-foot-wide gravel trail built on the existing railbed along the east side of Lake Sammamish. SEPA, NEPA, and associated wetland studies for the Interim Use Trail have already been completed and decisions rendered (Parametrix et al. 2000a).

3. Construction of the Interim Use Trail was completed in 2004 in two locations: the city of Redmond and the city of Issaquah. The 7-mile midsection in the city of Sammamish may be built during 2005. Thus, this report assumes the existence and ongoing operations of the Interim Use Trail in the railbanked King County right-of-way.

4. Mitigation has been provided for wetlands impacted by gravel placement and operation of the Interim Use Trail, including those areas to be constructed during 2004 or 2005. This report assumes that all wetland regulatory requirements for the Interim Use Trail have been met.

5. The Master Plan Trail, the subject of this report, would be largely built in the same right-of-way as the Interim Use Trail. The Master Plan Trail would be built over the Interim Use Trail in generally the same location, or parts of the Interim Use Trail would be incorporated into the Master Plan Trail and the Master Plan Trail would be built adjacent to parallel roads.

6. In addition to Lake Sammamish, approximately 78 palustrine wetland systems have been identified in the 11.7-mile study area.

1.1 ORGANIZATION OF THIS REPORT

This report is organized into five sections:

- Section 1 describes the project's purpose and need, the project alternatives and proposed actions, the scope of this report, and the study area.
- Section 2 describes the methods used for wetland delineation and wetland and buffer functional assessment.
- Section 3 describes the affected environment, specifically, wetlands and wetland buffers and their functions.
- Section 4 describes and evaluates the potential impacts to wetland area and functions and buffer areas and functions and provides a cumulative impacts assessment.
- Section 5 provides a conceptual plan to mitigate impacts and compensate for unavoidable impacts.

1.2 PROJECT PURPOSE AND NEED

The purpose of the Master Plan Trail is to design and construct an alternative non-motorized transportation corridor and multi-use recreational trail[1] along the east side of Lake Sammamish located in Issaquah, Sammamish, and Redmond, Washington, USA (Figures 1-A, 1-B, and 1-C).

The multi-use Master Plan Trail would provide non-motorized access to recreation, employment, and retail centers and complete a link in the regional trail system. The trail is intended to safely accommodate a variety of user groups such as bicyclists, pedestrians, runners, wheelchair users, in-line skaters, and equestrians. Trail design standards will safely accommodate different ages and skill levels within those groups.

The Master Plan Trail would:

- Help satisfy the regional need for alternative commuter transportation corridors by providing an option that could reduce the number of vehicles on area roadways.
- Help satisfy the regional need for recreational trails and provide safe recreational opportunities to a wide variety of trail users.
- Provide a critical link in the regional trails system.
- Provide recreational users with safe and enjoyable corridors connecting major parks, development, and retail centers.

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[1] A multi-use trail is synonymous with a "shared-use path or trail" as defined by the American Association of State Highway and Transportation Officials (AASHTO), "a multi-purpose trail" as defined in the King County Regional Trails Plan, and a "Class 1 bikeway" as defined in WSDOT's Facilities for Non-Motorized Transportation.

Figure

1-A East Lake Sammamish Trail Alternatives – North Segment

Figure

1-B East Lake Sammamish Trail Alternatives – Central Segment

Figure

1-C East Lake Sammamish Trail Alternatives – South Segment

1.3 BACKGROUND AND HISTORY

1.3.1 Right-of-Way Acquisition and Railbanking

In 1996, the Burlington-Northern/Santa Fe Railroad (BNSF) ceased operations on its railroad track between Redmond and Issaquah (now referred to as the East Lake Sammamish corridor). The Cascade Land Conservancy (formerly the Land Conservancy of Seattle and King County) purchased the active railroad right-of-way from BNSF in April 1997. The Land Conservancy sold the right-of-way on September 18, 1998 to King County. King County purchased the right-of-way with the intention of developing the right-of-way into the East Lake Sammamish Trail. As part of the acquisition agreement, the Land Conservancy retained the right to salvage rails, ties, and spikes, and as part of the salvage operation, a significant amount of gravel and rock was placed on the railbed for erosion and sediment control.

The former BNSF rail corridor was formally railbanked by the Land Conservancy in 1996. In 1983, Congress, recognizing rail right-of-ways as an irreplaceable national asset, adopted amendments to the National Trail Systems Act (P.L. 90-543, 16 USC 1241 et. seq., as amended through P.L. 102-461) to preserve rail corridors through what has become known as railbanking. Railbanking is a process that preserves rail corridors for future railroad use while allowing other compatible uses in the interim period.

1.3.2 Right-of-Way Maintenance and Management

Under railbanking rules, King County is responsible for maintaining and managing the right-of-way to preserve the integrity of the former railbed to accommodate potential reestablishment of rail service. King County intends to fulfill this obligation by installing and operating an alternative transportation and recreational trail.[2]

In keeping with their management obligations, prior to operation of the Interim Use Trail, the King County Division of Parks and Recreation (KCDPR) implemented the restoration and maintenance of facilities along the King County right-of-way. Between 1999 and 2003, KCDPR has repaired drainage systems and culverts at over 40 locations along the King County right-of-way. Currently, King County provides routine maintenance and repair of the Interim Use Trail, including trail, drainage system, and vegetation management. The KCDPR crew mows and removes litter regularly. They also replace deteriorated driveway crossings, install signage, and remove hazardous trees. In addition, they are often required to remove illegally dumped household waste, yard clippings, and construction debris from locations, such as ditches and wetlands, in the King County right-of-way.

1.3.3 Phased Development

In 1999, King County held community meetings to discuss trail planning and formed a Citizens Advisory Group (CAG). Responding in part to public input and concerns regarding potential impacts, the County developed a plan to develop the Master Plan Trail in phases. A number of the decisions to be made for the long-term, permanent trail were not yet ready for evaluation or decision (e.g., final alignment of the trail, ultimate users of the trail, trail width, trail amenities, and support facilities). A phased approach was taken, since such final trail decisions would be complex and controversial and would require further public process and discussion to provide meaningful evaluations.

[2] King County is obligated to maintain the entire former railbed regardless of its use as a trail.

The first phase of the Master Plan Trail was encompassed in the *East Lake Sammamish Trail Interim Use and Resource Protection Plan* (King County 2000). This phase allowed public use of the railbanked trail corridor as an Interim Use Trail, while protecting natural resources and human safety until the planning for a long-term, permanent trail could be completed and implemented. Development of the Interim Use Trail included removal of the remaining rail ties; adding gravel to the surface of the existing railbed; installing fencing, signage, and litter receptacles; and maintaining existing ditches and culverts.

The SEPA and NEPA documents for this phase only evaluated interim trail operation through 2015 to provide a time frame in which environmental impacts could be evaluated. In 2015, permitted interim use of the trail would expire in the absence of additional environmental review. In Phase 2, the Master Plan, the No Action Alternative is the Interim Use Trail.

1.3.4 Interim Use Trail Description

The Interim Use Trail construction removed the few remaining rail ties, added 4 inches of 5/8-minus crushed surfacing material to the existing railbed, installed fencing to protect critical areas, and provided signage and litter receptacles. All permits necessary to construct the trail within the cities of Redmond and Issaquah were obtained in 2003, and construction in these areas was completed in early 2004. Construction of the remaining segment located in the city of Sammamish is expected to be completed in 2004 or 2005.

1.4 PROJECT DESCRIPTION AND ALTERNATIVES

The Master Plan Trail is to be constructed on the east side of Lake Sammamish to offer an alternative to commuters who travel along the increasingly congested East Lake Sammamish Parkway, to provide access to recreation, employment, and retail centers in the cities of Redmond, Sammamish, and Issaquah, and to complete a link in the regional trails system. The Master Plan Trail will provide a crucial link between the Burke-Gilman/Sammamish River Trail and the Mountains to Sound Greenway, and will connect two of the most popular parks on the Eastside – King County's Marymoor Park near Redmond and Lake Sammamish State Park in Issaquah. The East Lake Sammamish Trail was first identified in an adopted county plan in 1971. The northern terminus of the Master Plan Trail is 500 feet west of Bear Creek in the city of Redmond. The southern terminus is at the intersection of the railbanked corridor with Gilman Boulevard in the city of Issaquah (see Figures 1-A and 1-C).

The Master Plan Trail differs from the existing Interim Use Trail in that the Master Plan Trail is intended to accommodate a wider variety of trail users with design features based on American Association of State Highway and Transportation Officials (AASHTO) recommendations for a "shared use path," including a paved surface and a greater width than the Interim Use Trail. The Master Plan Trail also adds amenities such as parking, restrooms, and access paths, and may accommodate equestrian use, which is currently prohibited on the Interim Use Trail.

Six alternatives are being evaluated in detail in the Draft SEPA/NEPA EIS for the Master Plan Trail:

1. The No Action Alternative: The Interim Use Trail expires in 2015, and public access and use of the trail would cease.
2. The No Trail Alternative: The Interim Use Trail would be immediately decommissioned upon adoption of decision, and public access and use of the trail would immediately cease.
3. The Continuation of the Interim Use Trail Alternative.
4. The Corridor Alternative.
5. The East A Alternative.

6. The East B Alternative.

These are described below in more detail. Alternatives 3 through 6 together are referred to in this document as the build alternatives.

1.4.1 No Action and No Trail Alternatives

Under the No Action Alternative (Alternative 1), King County would continue to operate the existing Interim Use Trail through 2015, at which time, in the absence of additional environmental review, the operation of the trail would expire. The No Trail Alternative (Alternative 2) would involve immediate decommissioning of the Interim Use Trail. The operation of the Interim Use Trail would cease and aspects of the trail would be decommissioned as soon as this alternative was adopted.

1.4.2 Continuation of the Interim Use Trail Alternative

In this alternative, the Interim Use Trail would be continued beyond 2015. This soft-surface trail varies in width between 8 and 12 feet and does not have shoulders. The trail is currently operating between Gilman Boulevard in Issaquah and a few hundred feet north of NE 70th Street in Redmond and does not extend to Bear Creek in Redmond.

The Continuation of the Interim Use Trail Alternative is considered a build alternative because ancillary facilities (i.e., parking and restrooms) would be designed and constructed and stormwater facilities would be upgraded, although little change would occur to the trail itself. A short section of railbed not developed north of NE 70th Street would receive 4 inches of 5/8th-minus gravel for most of the extent to extend the trail across Bear Creek in Redmond.

The Interim Use Trail would continue to accommodate pedestrian and limited wheeled use on the gravel surface. Although currently prohibited, the potential to allow equestrian use on the trail is evaluated as part of this alternative. The potential impacts to wetlands from construction and operation of the Interim Use Trail were provided in the NEPA and SEPA documentation. The Continuation of the Interim Use Trail Alternative is evaluated in the EIS because, during the screening process, resource and permitting agency representatives expressed a concern that if the impacts of the wider paved trail were prohibitive, additional review could potentially be required to continue the reduced trail section.

1.4.3 Corridor Alternative

The shared use trail would be located within the railbanked King County right-of-way (see Figures 1-A, 1-B, 1-C; Appendix A: Corridor Alternative). The majority of the trail would encompass the existing Interim Use Trail, leaving this alignment only in those places where trail safety could be improved. The trail would accommodate pedestrian, wheeled, and equestrian uses.

The minimum design section includes 12 feet of pavement bounded by two 2-foot shoulders and two 1-foot clear spaces (Table 1-1). However, under current guidelines, the ideal width of the trail to safely accommodate multiple uses is 27 feet. This includes a 3-foot clear zone, 4-foot pedestrian/equestrian trail, 3-foot vegetated buffer, two 2-foot gravel shoulders, 12-foot paved trail, and 1-foot vegetated clear zone. In a few instances, the separation between the paved trail and the pedestrian/equestrian trail would increase to take advantage of existing topography (see Appendix C for illustrations of typical trail sections).

Based on the preliminary design concept, the proposed trail width narrows to 21 feet, 19 feet, or 18 feet in some areas to avoid existing structures, preserve access to adjacent properties, avoid and minimize impacts to sensitive areas, and increase safety at vehicle crossings. The narrowing is accomplished by combining uses and/or reducing trail clear zone; however, the paved width of the multi-purpose trail is never less than 12 feet, and the width of each shoulder is never less than 2 feet. The narrower trail is not proposed for extended distances because this could potentially compromise trail safety.

Table 1-1. Descriptions of Typical Trail Sections Used Within the Continuation of the Interim Use Trail, the Corridor Alternative, or the East Alternatives

Name	Alternatives Used In:	Total Trail Width (feet)	Paved Portion (ft)	Shoulders (combined) Width (ft)	Pedestrian/ Equestrian Path Width (if present) (ft)	Clear Zone (ft)	Vegetation Buffer (combined width) (ft)
Interim Use Trail	Continuation	8 to 12	None	None	None	1 to 2	None
A - Primary cross section	Corridor and East	27	12	4	4	4	3
B - Separated equestrian	Corridor and East	Varies	12	4	4	2	Varies
C - Combined, no planting	Corridor and East	21	12	7	None	2	None
D - Combined	Corridor and East	19	12	5	None	2	None
E - No parallel pedestrian/ equestrian	Corridor and East	18	12	4	None	2	None
F - Combined with new residential parking and sidewalk	Corridor	18	12	4	None	2	None
G - Combined with residential parking	Corridor and East	18	12	4	None	2	None
H - At East Lake Sammamish Parkway	East	21	12	4	None	1	4
I - At East Lake Sammamish Place	East	21	12	4	None	1	4

The Master Plan Trail would be open for public use during daylight hours seven days a week. The trail would not be illuminated. The posted speed limit for trail users would be 15 miles per hour (mph). After applying a safety factor, the design speed for the Corridor Alternative and both the East A Alternative and East B Alternative was 20 mph. Litter receptacles, doggy litterbag boxes, and trail etiquette signs would be provided at public access points.

1.4.4 East A Alternative

The East A Alternative is a more fully engineered form of a plan called "The Rundle/Haro Plan," which was generated in 2000 as a citizens-proposed alternative to a trail entirely within the railbanked right-of-way.[3] This alignment encompasses the Interim Use Trail in certain segments and transitions to the parkway shoulder at the following locations (Appendix B):

- At many driveway/public roadway intersection.

[3] The process undertaken to develop the East A Alternative is described in detail in the *Revised Summary of Screening Criteria* (Parametrix 2004).

- Along 1.7 miles of divided properties.
- To avoid sensitive areas.
- In other locations where the Rundle/Haro Plan calls for the transition.

Bicyclists would have the option of remaining in the bike lanes on the parkway. Where the alignment for the paved portion leaves the Interim Use Trail alignment, pedestrian and equestrian use would continue on the existing trail.

The width of the paved portion is not less than 12 feet, the same as that proposed in the Corridor Alternative, and varies in width from 18 to 21 feet including clear space during transitions and at segments adjacent to public roads (refer to Table 1-1). Because the East A Alternative is very similar to the East B Alternative (see next), the East A Alternative and the East B Alternative will often be referred together as the East Alternatives in this report.

1.4.5 East B Alternative

This alternative is identical to the East A Alternative except that pedestrian and equestrian use would not be allowed on the existing Interim Use trail. All users of the trail would transition from the Interim Use Trail alignment to the roadway when the paved portion transitions to the roadway. No separated soft-surface facility would be available where the trail is located on roadway shoulders.

1.4.6 Support Facilities

Three new parking and two restroom facilities are proposed. The number and location of existing and proposed parking and restrooms are the same regardless of the build alternative. These facilities generally include a 500-square-foot restroom facility and parking for 20 cars or 10 car-trailer combinations.

New parking and restroom facilities would be provided in the following locations:

- An area between NE 65th Street and NE 70th Street in Redmond (parking only, no restrooms).
- The west side of East Lake Sammamish Parkway at approximately $\text{Station}_{\text{COR}}$[4] 465 to 469.
- $\text{Station}_{\text{COR}}$ 280, on the east side of the King County right-of-way at the intersection of East Lake Sammamish Parkway and SE 33rd Street.

1.4.7 Fencing

At least three types of fencing would be installed and maintained. Different fencing types would be installed for the following situations:

- Guardrail or approved equivalent would be used along roads, driveways, and parking areas to delineate and separate the trail from areas used by vehicles.
- Five-foot, black-coated chain-link fencing would be used where guardrail is not required and where (1) less than 20 feet exist between the trail and a home; (2) docks and waterfront property create a safety, liability, proximity and trespass, and/or privacy concern; and (3) the edge of the trail represents a hazard to trail users (i.e., is immediately adjacent to a drop off).
- Split rail fencing would be located in other areas adjacent to environmentally critical areas such as wetlands, streams, and steep slopes. This fencing is intended to reduce the risk of intrusion from humans and pets while allowing small wildlife movement in critical areas. In addition, in

[4] The subscript "COR" is used to reference stationing along the Corridor Alternative. This is included because the stationing is different for the Corridor Alternative and the East Alternatives.

some areas, dense planting of native shrubs (e.g., salmonberry, roses) and trees in these areas may help to limit foot traffic in sensitive areas or buffers.

The approximate fence locations for both the Corridor Alternative and the East Alternatives are shown on the design sheets located in Appendices A, B, and C. The fencing would be placed no closer than 1 foot from the outside edge of the trail shoulder, maintaining the 1-foot clear zone. Where retaining walls are installed, fencing will be placed along the top of the walls.

Split rail fences were installed for the Interim Use Trail adjacent to wetlands and buffers. For the Continuation of the Interim Use Trail Alternative, these fences would remain in place, although additional fencing might be installed at other locations such as near new ancillary facilities.

1.4.8 Retaining Walls

Preliminary designs for the Corridor Alternative and the East Alternatives include cut and fill lines based on 3:1 slopes. However, in some areas, a 3:1 fill slope would require filling or cutting outside of the King County right-of-way or would result in potential impacts to adjacent roads or residences. In these locations, retaining walls would be designed to avoid impacts outside the right-of-way.

1.4.9 Drainage Facilities

All of the proposed build alternatives will require maintaining or upgrading the existing drainage system. New ancillary facilities will require new stormwater control facilities. For any portion of the proposed build alternatives not located in the railbanked corridor, routine maintenance and planned replacement of drainage systems along the corridor would continue, as well as drainage improvements associated with the trail.

1.4.10 Vegetation Management

Vegetation management is a current and ongoing process in the operation of the Interim Use Trail. Vegetation management would proceed as needed to meet the requirements of railbanking alone or for any of the build alternatives.

Vegetation located adjacent to the trail would be trimmed or removed to achieve the following:

- Maintain sight distances on the approaches to an intersection, where vegetation potentially prevents a vehicle or trail user from identifying an obstruction and stopping in time to prevent an accident.
- Remove trees or limbs located within the King County right-of-way that present a hazard to trail users or adjacent structures, roadways, or utilities or would present an obstacle to reestablishing rail service.
- Remove noxious weeds and replace them with appropriate plantings.
- Maintain drainage systems (e.g., conveyance ditches) through activities such as slope mowing, dry ditch cleaning, wet ditch cleaning, and repairing or replacing damaged culverts.
- Maintain vertical and horizontal clearances for maintenance and emergency vehicles, as well as for trail users.
- Implement and maintain approved mitigation for the Master Plan Trail.

A vegetation management plan was prepared in conjunction with the implementation of the Interim Use Trail (Parametrix 2002a). The plan describes in detail the circumstances under which vegetation is managed and removed; applicable King County standard practices, policies, and procedures; and site-specific conditions and considerations, including work within critical areas such as wetlands, streams, and steep slopes. The vegetation management plan specifically identifies wetlands and their buffers as areas where native vegetation is preferentially preserved and replaced if needed.

The vegetation management plan developed under the Interim Use Trail permitting phase provides prescriptions for appropriate techniques of vegetation management in wetlands and wetland buffers, including minimizing native plant disturbance, controlling invasive and noxious weeds, and replanting with appropriate native plant species. Vegetation management may impact wetland and wetland buffer vegetation when native species are removed. Vegetation management also may have beneficial effects on wetland and buffer vegetation when it leads to a reduction of invasive plant species, e.g., removal of Himalayan blackberry (*Rubus armeniacus*). The extent of impact or benefit from vegetation management varies for each area's local situation.

1.5 DESCRIPTION OF THE STUDY AREA

The study area for this report includes the 11.7-mile King County right-of-way that extends from Gilman Boulevard in Issaquah to Bear Creek in Redmond. The King County right-of-way width varies from 50 to 200 feet. The study area also includes the area between the King County right-of-way and East Lake Sammamish Parkway in locations where the East Alternatives leave the King County right-of-way and travel along the parkway. In addition, the study area includes the west side of the parkway and East Lake Sammamish Place in places where the East Alternatives parallel the roadway shoulder.

1.5.1 Setting

The study area is within the Urban Growth Boundary (UGB) and is largely suburban and urban. The only large areas of open space occur in Marymoor Park and Sammamish State Park, which are adjacent to the King County right-of-way at the north and south ends of the study area, respectively.

In the city of Sammamish, single-family homes adjoin the study area for most of its extent. Residents access many of these houses by crossing the King County right-of-way. Single and multifamily residential as well as some retail, commercial, and light industrial areas are adjacent to the study area in the cities of Redmond and Issaquah.

East Lake Sammamish Parkway is a north-south regional arterial road that largely parallels the King County right-of-way and generally defines the east side of the study area. Very near the study area's northern terminus, the trail crosses State Route (SR) 520 near the intersection with SR 202 in Redmond. In the southern portion of the study area, the trail crosses beneath Interstate 90 (I-90) in Issaquah.

1.5.2 Geology and Topography

Existing topography in the study area and vicinity (Figure 2) was heavily influenced by the Vashon Ice Sheet, which occupied the area and retreated to the north approximately 13,000 years ago. Lake Sammamish occupies a glacially excavated, elongate trough bounded by north-south trending elongate ridges and drift uplands.

The central 7 miles of the study area is located on the eastern slope of this trough, near the toe of slope and near the lakeshore. The crest of the slope lies to the east (Sammamish Plateau), ranges generally from 150 to 165 feet in elevation, and is within 0.5 mile of the study area. The study area passes perpendicular to steep, erosion- or landslide-prone slope faces, including the slopes lying between the Interim Use Trail and the parkway. Because the study area follows a toe of slope, it also lies perpendicular to the regional drainage pattern.

The northern and southern portions of the study area lie on relatively flat alluvial plains bounded by ridges and drift plains (north) or generally east-west trending foothills (south). In the Redmond area, the study area departs from the Lake Sammamish trough and crosses the alluvial valley formed by Bear and Evans Creeks. In the south, the study area crosses the alluvial plain formed by Issaquah Creek and its tributaries.

The surficial geology crossed by the study area includes alluvium deposited by streams and landslides, and lacustrine and glacially deposited silts. Dense to very dense Vashon-age, glacially consolidated deposits form the slopes, with loose to medium-dense deposits derived from post-glacial erosion and landslides forming the lower areas. Both the former railbed and the adjacent roads are engineered on cuts in the dense materials. In a few locations, the former railbed and roads are built on fills in former wetland and other loose alluvium. The Geology Technical Back-up (Parametrix 2004a) provides more detailed information on the local area geology.

Elevations along the study area range from 42 feet in the northern end to 70 feet along the southern extent. The study area is fairly flat at the north and southern extents, and thus the parkway is at nearly the same elevation as the Interim Use Trail (built on the former railbed). In contrast, along the central 7 miles, the study area is on a slope, where the Interim Use Trail is generally located near 45 feet elevation. The parkway is east of the Interim Use Trail and generally located 20 to 80 feet upslope. Where the East Alternatives are on the parkway or East Lake Sammamish Place in the central section of the study area, the roads are as much as 200 feet east of the Interim Use Trail and the lakeshore.

1.5.3 Watersheds and Streams

The study area occurs in the Lake Sammamish watershed (Water Resource Inventory Area [WRIA] 8). This 170-square-mile area lies on the eastern fringe of King County's urban area. Overall, the watershed contains a mix of land uses that include urban areas, agriculture, numerous parks, and public and private working forests. The watershed is split by the UGB with approximately the western 50 percent within the UGA. The study area crosses three watersheds within the Sammamish watershed; these are (south to north) (1) Issaquah Creek Watershed, (2) East Lake Sammamish Watershed, and (3) Bear Creek Watershed.

The southern portion of the study area (from downtown Issaquah to north of Sammamish State Park) crosses through the Issaquah Creek Watershed. The Issaquah Creek Watershed is an urbanizing watershed of 373 square miles. The study area crosses the North Fork of Issaquah Creek at $\text{Station}_{\text{COR}}$ 123. The North Fork joins with Issaquah Creek approximately 0.25 mile west of the study area. Issaquah Creek drains to Lake Sammamish in Sammamish State Park.

Approximately 7 miles of the study area are within the East Lake Sammamish Watershed. This basin is divided into several basins, including, from south to north, the Laughing Jacobs, Pine Lake, Thompson, Monohon, Inglewood, and Panhandle basins. As stated earlier, the study area in this vicinity lies perpendicular to the regional drainage pattern, and thus crosses approximately 46 cataloged stream channels and drainages. While most streams are small and seasonal, the larger streams include Laughing Jacobs, Pine Lake, Zaccuse, Ebright, and George Davis Creeks. All of these streams drain to Lake Sammamish.

The Bear Creek Watershed lies in the northern portion of the study area from approximately NE 65th Street northwest to downtown Redmond. The Bear Creek system drains into the Sammamish River (the outlet of Lake Sammamish) and is one of the major salmon-producing systems in King County. The study area crosses Bear Creek at $\text{Station}_{\text{COR}}$ 677 at the northern terminus of the project.

Throughout the study area, some larger streams contain salmon populations or potential salmon habitat (Parametrix 2004b). Most streams are not known to support anadromous fish species, and many are too small to support resident fish. As documented in the *Fish Technical Study* (Parametrix 2004b), populations of salmon and other resident fish use the nearshore environment of Lake Sammamish for breeding and rearing. See the *Fish Technical Study* for more detailed information on streams and fish populations in the study area (Parametrix 2004b).

1.5.4 Lake Sammamish and Wetlands

Lake Sammamish is the dominant hydrologic feature in the study area with a surface area of approximately 4,900 acres and is one of the largest natural lakes in the Puget Sound basin (King County 1991). Lake Sammamish receives flow primarily from Issaquah Creek and discharges through the Sammamish River to Lake Washington, through Lake Union, and to Puget Sound.

The lake is mapped by the National Wetlands Inventory (NWI) (USFWS 1987) as lacustrine wetland and deepwater habitat with both limnetic and littoral subsystems (see Appendix D). The majority of the lake is limnetic deepwater habitat with an unconsolidated (unvegetated) bottom. A few palustrine wetlands are also mapped in the vicinity.

The NWI maps also indicate littoral wetlands along the shore of Marymoor Park and Sammamish State Park. These wetlands extend lakeward from the lakeshore to a water depth of 6.6 feet and generally lack persistent emergent vegetation. There is one section of littoral wetland mapped by the NWI along the southern shore of Weber Point in Sammamish; this wetland area no longer exists due to adjacent development. In addition to fish and aquatic life, Lake Sammamish supports waterfowl, raptors, and other wildlife. The King County Wetland Inventory show wetlands located along Lake Sammamish and within 200 feet of the project vicinity. These are generally the same wetlands as shown on the NWI. Wetlands within and adjacent to the King County trail right of way are identified, mapped, and described in Section 3 of this report. Section 2 of this report describes the wetland studies and methods in detail.

1.5.5 Soils

Soils in the study area are mapped into 15 soil mapping units composed of 13 individual soil series (Snyder et al. 1973). The mapped soils have been categorized as either non-hydric (upland) (Table 1-2) or hydric (wetland) (Table 1-3 and Appendix E). Generally, soils in the study area are mapped as non-hydric. Hydric soil inclusions[5] are reported to occur within these non-hydric units (Snyder et al. 1973).

In the northern and southern portions of study area, soils that have formed in alluvium and former lake basin often have perennially or seasonally high groundwater and would be classified as hydric. These areas generally were also mapped as wetlands by the soil survey and NWI. The former railbed and much of the parkway is composed of fill soils. These fill soils are typically well drained, not hydric soils, and not wetland.

1.5.6 Vegetation

Vegetation in the study area was categorized into four major types: landscaped areas, deciduous forests (both upland and riparian), coniferous forests (upland only), and wetland (including forested, shrub, and emergent types) (Table 1-4). Plants identified during the field investigation are listed in Appendix F.

[5] Inclusions are areas of distinct soil types that are too small to be mapped separately.

Figure

2 Topography in the Vicinity of the East Lake Sammamish Master Plan Trail

Landscaped areas are the most predominant vegetation type in the study area. This cover type contains a mix of buildings, asphalt, gardens, and lawns. Native trees present include bigleaf maple (*Acer macrophyllum*) and Douglas-fir (*Pseudotsuga menziesii*); non-native Himalayan blackberry and Scots broom (*Cytisus scoparius*) are dominant shrubs. A variety of ornamental tree and shrub species are also common in areas of maintained yards. In un-mown grassy areas, non-native pasture species predominate.

Deciduous forests consist of trees such as Oregon ash (*Fraxinus latifolia)*, black cottonwood (*Populus balsamifera*), and bigleaf maple with an understory of swordfern (*Polystichum munitum*), salal (*Gaultheria shallon*), Himalayan blackberry, and salmonberry (*Rubus spectabilis*). Trees are generally more than 40 feet tall, and some cottonwoods reach more than 150 feet in height.

Coniferous forests consists of mostly coniferous trees, including Douglas-fir, western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*), with an understory of swordfern, low Oregon grape (*Mahonia nervosa*), Himalayan blackberry, and English ivy (*Hedera helix*). Trees in this cover type are generally 40 to 80 feet tall. Coniferous tree cover occurs as small patches (up to approximately 2 acres) in upland areas.

Reed canarygrass (*Phalaris arundinacea*), willow, and/or Himalayan blackberry dominate many wetland areas.

1.5.7 Threatened, Endangered, and Sensitive Plant Species

1.5.7.1 *Plant Species with Federal Status*

No federally listed plant species are known to occur in the project vicinity (Appendix L).

1.5.7.2 *Species with State Status*

The Washington Natural Heritage Program (NHP; DNR 2004) has developed a list of plant species considered to be threatened, endangered, or sensitive within the State of Washington. Data from the NHP indicates that a state sensitive plant species, shining flatsedge (*Cyperus bipartitus [= C. rivularis]*), was reported growing approximately 0.02 mile from the rail corridor in the vicinity of Sammamish State Park. This small, annual sedge occurs on sandbars adjacent to freshwater lakes and streams.

The Puget Sound area represents the northwestern extent of shining flatsedge's broad distribution, which includes most of North America extending from southern Canada south to South America. Only a few populations are currently known within the State of Washington. These populations are considered vulnerable or declining. The Washington State Department of Natural Resources (DNR) could list the species as threatened or endangered in the future. However, throughout its global range, the species is demonstrably secure (DNR 2004, see Appendix L).

The species was not observed to occur within the rail corridor or other locations in the project area. No habitats that are potentially suitable for this species will be altered. No high-quality undisturbed wetland or terrestrial ecosystems are located in the project vicinity (DNR 2004, see Appendix L).

Table 1-2. Non-hydric Soils Mapped in the Vicinity of the Study Area

Non-hydric Soils	Phase	Slope (percent)	Drainage Class	Parent Material	Landscape Position	Erosion Hazard	Taxonomic Subgroup	Soil Order
Alderwood	Gravelly sandy loam	6 to 15 and 15 to 30	Moderately well drained	Glacial till	Terraces	15 to 30: severe	Entic Durochrepts	Inceptisol
Everett	Gravelly sandy loam	5 to 15 and 15 to 30	Somewhat excessively well drained	Glacial outwash	Terraces and terrace fronts	15 to 30: moderate to severe	Dystric Xerochrepts	Inceptisol
Indianola	Loamy fine sand	0 to 4	Somewhat excessively drained	Sandy recessional glacial drift	Smooth terraces	Slight	Dystric Xeropsamments	Entisol
Kitsap	Silt loam	2 to 8 and 15 to 30	Moderately well drained	Glacial lake deposits	Terraces and strongly dissected terrace fronts	15 to 30: severe	Dystric Xerochrepts	Inceptisol
Alderwood/ Kitsap complex	50% Alderwood, 25% Kitsap, 10% Indianola, 15% unnamed	25 to 70	Varied	Glacial till, outwash, and lake deposits	Terrace fronts	Severe to very severe	N/A	N/A
Ragnar/Indianola complex	50% Ragnar fine sandy loam, 50% Indianola loamy fine sand	2 to 15 (convex) and 15 to 25 (convex to concave)	Well drained	Glacial outwash	Glacial outwash terrace fronts	Severe for steep slopes	N/A	N/A
Mixed alluvial land: areas too small and too closely associated to map separately at the scale used	Ranges from sand and gravelly sand to silty clay loam	Less than 2	From well drained to very poorly drained	Alluvium	Stream and river valleys	Slight	N/A	N/A

Table 1-3. Hydric Soils Mapped in the Vicinity of the Study Area

Hydric Soils	Phase	Slope (percent)	Drainage Class	Parent Material	Landscape Position	Taxonomic Subgroup	Soil Order
Bellingham	Silt loam	Less than 2	Poorly drained	Alluvium	Depressions on till plains	Typic Humaquepts	Entisol
Earlmont	Silt loam	Less than 2	Somewhat poorly drained	Diatomaceous lake deposits	Lake beds	Typic Fluvaquents	Entisol
Norma	Sandy loam	Less than 2	Poorly drained	Till and alluvium	Stream bottoms and depressions on till plains	Fluventic Humaquepts	Inceptisol
Oridia	Silt loam	Less than 2	Somewhat poorly drained	Alluvium	River valleys	Typic Fluvaquents	Entisol
Sammamish	Silt loam	Less than 2	Somewhat poorly drained	Alluvium	Stream valleys	Fluvaquentic Humaquepts	Inceptisol
Seattle	Muck	Less than 1	Very poorly drained	Sedges	Depressions and stream valleys on till plains	Typic Medihemist	Histosol
Shalcar	Muck	Less than 1	Very poorly drained	Stratified organic material and alluvium	Depressions and stream valleys on till plains	Terric Medisaprists	Histosol
Woodinville	Silt loam	Less than 2	Poorly drained	Alluvium	Stream bottoms	Typic Fluvaquents	Entisol

Table 1-4. Typical Plant Species Present in the Study Area

Vegetation Community	Frequency[a]	Typical Species	Common Name	*Scientific Name*
Landscaped Areas	70%	Overstory	Ornamental and native trees	
		Understory	Mixed turf grasses Ornamental shrubs	
Coniferous Forest	5%	Overstory	Douglas-fir Western red cedar Red alder	*Pseudotsuga menziesii* *Thuja plicata* *Alnus rubra*
		Understory	Salal Swordfern Evergreen huckleberry Indian plum Vine maple	*Gaultheria shallon* *Polystichum munitum* *Vaccinium ovatum* *Oemleria cerasiformis* *Acer circinatum*
Deciduous Forest	5%	Overstory	Bigleaf maple Red alder	*Acer macrophyllum* *Alnus rubra*
		Understory	Beaked hazelnut Swordfern Salal Common snowberry Himalayan blackberry Oregon grape	*Corylus cornuta* *Polystichum munitum* *Gaultheria shallon* *Symphoricarpos albus* *Rubus armeniacus* *Mahonia aquifolium*
Wetland	10%	Forested	Black cottonwood Oregon ash Pacific willow	*Populus balsamifera* *Fraxinus latifolia* *Salix lucida* var. *lasiandra*
		Shrub	Pacific ninebark Sitka willow Himalayan blackberry	*Physocarpus capitatus* *Salix sitchensis* *Rubus armeniacus*
		Emergent	Reed canarygrass Soft rush Cattail	*Phalaris arundinacea* *Juncus effusus* *Typha latifolia*

[a] Approximate percent of the study area dominated by each community type.

1.5.8 Threatened and Endangered Wildlife and Other Wildlife Species of Concern

This section describes threatened, endangered, and other wildlife species of state and federal concern that are known to occur or may occur in the wildlife analysis area. These wildlife species are listed in Appendix F.

Species with Federal Status

The U.S. Fish and Wildlife Service (USFWS) identified six threatened or endangered wildlife species as potentially occurring in King County: bald eagle (*Haliaeetus leucocephalus*), Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), marbled murrelet (*Brachyramphus marmoratus*), and northern spotted owl (*Strix occidentalis caurina*) (USFWS 2004). USFWS also identified one candidate species, the yellow-billed cuckoo (*Coccyzus americanus*), as potentially occurring in King County (USFWS 2004). Given the location of the project and the habitat in the vicinity, only one of these species, the bald eagle, is known or likely to occur in the project vicinity. Distribution of bald eagles in the area is described further below.

Bald Eagle

Bald eagles generally occur along shores of saltwater and freshwater lakes and rivers that support substantial prey densities (generally anadromous fish or waterfowl) (Livingston et al. 1990; Stalmaster 1987). Breeding bald eagles use large trees for nesting that are generally within a mile of water and have an unobstructed view of water (ODFW 1996; Anthony and Isaacs 1989). Both breeding and wintering bald eagles forage over open water and use riparian trees, often cottonwoods, for perching.

Area residents report observing bald eagles in the vicinity of the wildlife analysis area (Eychaner 1999; Ray 2000), and Washington Department of Fish and Wildlife (WDFW 2004) has identified two bald eagle breeding territories in the vicinity. The breeding territory on the south side of Lake Sammamish encompasses the King County right-of-way and contains one nest site, which is about 0.25 mile from the Interim Use Trail and is not within line of sight. The site was active from 1998 through 2001 and has not been monitored since that time (Stofel 2004 personal communication). The breeding territory on the north side of the lake, which also encompasses the King County right-of-way, contains a nest in Marymoor Park, about 630 feet from the Interim Use Trail. Eagles began using this nest, which is within line of site of the Interim Use Trail, when deciduous trees lack leaves, during spring 2000. The nest site was active in 2001 and 2003 and was not monitored in 2002 (Stofel 2004 personal communication). Through summer 1999, the eagle pair associated with this territory nested in a cottonwood on the edge of the model airplane field at Marymoor Park. However, this nest tree blew down in the fall/winter 1999. Wintering bald eagles forage along Lake Sammamish and perch in large cottonwood trees in the wildlife analysis area vicinity.

Species with State and/or Local Status

One state-listed endangered species, the western pond turtle (*Clemmys marmorata*), and one threatened species, the bald eagle, are known to occur in the wildlife analysis area vicinity (WDFW 2004, see Appendix L). The bald eagle is discussed in the Species with Federal Status section above. Two candidate species for state listing, the purple martin (*Progne subis*) and the pileated woodpecker (*Dryocopus pileatus*), are known to occur in the vicinity (WDFW 2004). The great blue heron (*Ardea herodias*) and the osprey (*Pandion haliaetus*), whose nest sites are protected by federal and state regulations, are known to nest in the vicinity of the King County right-of-way (WDFW 2004). Great blue heron rookeries are also afforded special protection by King County and the Cities of Issaquah and Sammamish.

Western Pond Turtle

The western pond turtle, a species of concern, occurs in streams, ponds, lakes, and permanent and ephemeral wetlands (Brown et al. 1995). This highly aquatic species spends most of its time in water but also requires terrestrial habitats for nesting, overwintering, and dispersal (WDFW 1993). Western pond turtles use floating vegetation, logs, rocks, and mud or sand banks for basking. Their historical distribution was from Mexico north to the Puget Sound (Brown et al. 1995). However, in recent years, the species has been nearly eliminated from the Puget Sound region, largely due to habitat alteration and loss, disturbance from humans, and introduction of non-native predators (WDFW 1993). Surveys indicate that only two viable populations remain in Washington state, one in Skamania County and another in Klickitat County (WDFW 1993). However, two western pond turtles have been sighted in the Marymoor Park wetlands, on the northwest side of Lake Sammamish (WDFW 2003). These turtle locations are approximately 1,320 feet and 1,650 feet from the Interim Use Trail.

Purple Martin

The purple martin is a summer resident of the Puget Sound area. This species breeds primarily near water and feeds on insects in open areas, often near moist and wet sites (WDFW 1991). Their presence appears to be limited by the availability of nesting cavities. A purple martin nest box is located near the north end of Lake Sammamish, about 650 feet from the Interim Use Trail. The WDFW records indicate that active nests have been found in this box, as well as in a cavity in nearby remnant pilings from an old cedar mill (WDFW 2004).

Pileated Woodpecker

The pileated woodpecker is generally associated with older forests that have large trees, snags, and coarse woody debris (Aubry and Raley 1993; Nelson 1988). The birds may also use younger forests for foraging, where snags are present (WDFW 2003). In addition, pileated woodpeckers are known to occasionally forage on suet feeders, utility poles, and fruit trees in suburban areas (WDFW 2003). A pileated woodpecker call was heard near Sulphur Point during site visits to the wildlife analysis area in spring 1999, and one was observed in Wetland 29C during a site visit in January 2000. Area residents also report seeing pileated woodpeckers in the wildlife analysis area vicinity (Eychaner 1999).

Great Blue Heron

The great blue heron is associated with both fresh and saltwater wetlands, seashores, rivers, swamps, marshes, and ditches (WDFW 2003). This species feeds on aquatic and marine animals in shallow waters and occasionally preys upon mice and voles (Calambokidis et al. 1985; Butler 1995). Nests of these colonial breeders are usually constructed in the tallest trees available at a given site (WDFW 2003). Great blue herons are frequently sighted in wetlands adjacent to the Interim Use Trail alignment, and one rookery is located near the alignment (Eychaner 1999; WDFW 2004). The rookery, which has been active since 1984, is south of Lake Sammamish at Lake Sammamish State Park, about 0.25 mile west of the Interim Use Trail.

Osprey

The osprey has no state or federal listing status but is protected under the federal Migratory Bird Treaty Act and the Revised Code of Washington (RCW). The act makes it unlawful to hunt, take, capture, kill, possess, sell, purchase, ship, transport, or export any migratory bird, part, nest, or egg; and under the Revised CRW 77.15.130, it is a misdemeanor to destroy the eggs or nests of protected species, including the osprey.

Ospreys are fish-eating birds that occur along lakes and rivers. The birds build large nests of sticks on snags or on living trees, and also readily nest on human-made structures, including power line towers, light poles, and similar structures (Poole 1989). On the coast, osprey nests are usually adjacent to, if not over, water, whereas on inland lakes and waterways, nests are usually more distant (i.e., up to 14 kilometers [km] but typically within 3 to 5 km) from foraging areas (Poole 1989). The majority of nests in Oregon and California studies were within 1 km of large lakes and rivers (Zarn 1974; Vana-Miller 1987).

One osprey nest is present within 0.5 mile of the proposed trail alignment. The nest is located on a cell phone tower in a light industrial area, approximately 30 feet from the existing rail embankment and the proposed trail alignment (WDFW 2004). The nest was discovered in 2001 and has been active since that time.

2. WETLAND STUDIES AND FIELD METHODS

Wetlands are defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register 1982, Federal Register 1985, the State Shoreline Management Act [SMA], and the State Growth Management Act [GMA)]). This section provides information on the methods and results of wetland identification and delineation in the study area.

2.1 WETLAND JURISDICTION AND BOUNDARY VERIFICATIONS

The majority of wetlands within the study area were delineated during late 1999 and early 2000 in the Interim Use Trail EIS process (Table 2-1). Boundaries were delineated for vegetated wetlands within the trail ROW or within 25 feet of the top edge of the railbed (Parametrix 2000). At that time, King County had jurisdiction in a portion of the study area. The remaining portions were with the Cities of Issaquah, Sammamish, and Redmond. Also during that time, King County Department of Development and Environmental Services (KCDDES) was providing project and permit review assistance to the Cities of Issaquah and Sammamish via interlocal agreements. Therefore, the delineated wetland boundaries in the study area were reviewed and verified by KCDDES wetland staff in 2000, and delineated wetlands within Sammamish jurisdiction were reviewed by the city of Sammamish in 2001. Delineated wetland boundaries in Redmond and Issaquah were not reviewed by the local jurisdiction in 1999 or 2000. Wetland boundaries determined in 2003 have not been reviewed by any agency at the time of this report. Wetland boundaries will be verified and reviewed as part of the final design and permitting for the Master Plan Trail.

As a result of annexation and incorporations since 2000, the study area now lies within locally incorporated jurisdictions, including the cities of Redmond, Sammamish, and Issaquah. No part of the study area is now under King County jurisdiction.

2.2 INFORMATION REVIEW

This report is based on the information presented in the technical documents produced in 1999 and 2000 during implementation of the Interim Use Trail and on documents produced in 2003 incorporating new wetland information, including information from the following sources:

- Draft Environmental Impact Statement East Lake Sammamish Interim Use Trail and Resource Protection Plan (Parametrix et al. 2000b)
- Final Environmental Impact Statement East Lake Sammamish Interim Use Trail and Resource Protection Plan (Parametrix et al. 2000a)
    - *East Lake Sammamish Interim Use Trail EIS: Appendix F, East Lake Sammamish Interim Use Trail Wetland Technical Report. April 2000.*
        - Appendix A to East Lake Sammamish Interim Use Trail Wetland Technical Report: Wetland Data Sheets
        - Appendix X to East Lake Sammamish Interim Use Trail Wetlands Technical Report: Wetland Atlas
        - Addendum to Wetland Technical Report, East Lake Sammamish Interim Use Trail (Addendum to Appendix F East Lake Sammamish Interim Use Trail, Parametrix 2002b)
- East Lake Sammamish Interim Use Trail, Vegetation Management Plan (Parametrix 2002a)

- East Lake Sammamish Interim Use Trail, Wetland Mitigation Plan (Parametrix 2002c)
- East Lake Sammamish Interim Use Trail, Evaluation of Stream and Wetland Buffer Impacts (Parametrix 2003a)
- Technical Memorandum Regarding Additional Wetland Areas (Parametrix 2003b)

Potential wetlands within and adjacent to the King County right-of-way were identified by reviewing existing information. This information was found in:

- NWI Maps—Issaquah and Redmond, Washington 7.5-Minute Quadrangle Maps (USFWS 1987)
- U.S. Geological Survey, Bellevue South 15-Minute Topographic Map (USGS 1985)
- Soil Survey King County Area (Snyder et al. 1973; see Appendix D)
- The King County Wetlands Inventory (King County 1990)[6]
- Washington Natural Heritage Program (Appendix L)
- Washington State Department of Fish and Wildlife Priority Habitat Information (Appendix L)
- 1998 aerial photographs (Walker and Associates, Seattle)

Information from these documents was used to identify vegetation patterns, topography, soils, streams, and other natural resources prior to conducting field studies. No U.S. Geological Survey (USGS) map is included with this report; however, topography information is included on the design set (Appendices A and B).

2.3 FIELD STUDIES

In addition to published information, a number of field studies have been performed. These are summarized in Table 2-1.

A wetland inventory of the King County right-of-way was performed in July 1999 using aerial photograph interpretation and field verification. Preliminary wetland numbers were assigned at the time of the inventory, working south from Sammamish State Park (1 through 10) and north from the State Park (11 through 34). Wetland boundary delineations were conducted from November 1999 through February 2000 for most wetlands in the study area. For the 1999–2000 study, wetland boundaries were delineated within the King County right-of-way for most of the right-of-way or within 25 feet of the top edge of the former railbed in limited areas.

The boundaries of a few of the wetlands in the study area have been estimated because they are on private property or because there was no available access. Boundaries that were estimated are clearly shown on the plan sheets in Appendices A and B. One area located within the King County right-of-way was not delineated because access was prohibited by adjacent property owners who use the King County right-of-way as their private yard.

Both natural and human-caused alterations have occurred in the area since the 1999–2000 field effort. During February of 2001, an earthquake caused lateral spreading of the former railbed shoulder in one location and of East Lake Sammamish Parkway in two locations. The earth shaking may have altered drainage in some locations sufficiently to change wetland hydrology.

[6] The cities of Redmond, Sammamish, and Issaquah use the King County Wetland Inventory.

Table 2-1. Summary of Field Efforts

Period	Activities	Comments
July 1999	Performed wetland inventory of the King County right-of-way.	Wetland conditions observed from top of former railbed only. Preliminary boundaries drawn on aerials.
November 1999 – February 2000	Flagged and delineated wetlands. Completed delineation data sheets. Surveyed wetlands. Developed atlas of wetlands.	Overall normal rainfall during this period, which lies outside the standard growing season. Entire King County right-of-way examined.
February 2002	Conducted additional review in response to King County wetland boundary verification.	Estimated wetland boundaries extended in three locations outside areas of potential impact. No delineation or survey.
June and July 2002	Evaluated functions using WSDOT Functional Assessment Method. Inspected wetland boundaries and conditions. Reviewed potential impacts from Corridor Alternative.	Changes to wetland areas within study area also noted.
January 2003	Evaluated buffer conditions within Sammamish city limits.	Buffer conditions in Sammamish are typical of buffer conditions in the study area.
January 2003	Reexamined three locations for wetland conditions.	Wetland boundaries redelineated in three locations, extending wetland areas slightly.
January 2004	Inspected potential impacts from the East Alternatives. Inspected King County Wetland Mitigation Bank.	
Various dates	Reviewed and confirmed previous observations. Assessed impacts, evaluated opportunities to avoid wetlands, etc.	Wetlands and buffers continued to be impacted by adjacent development in some locations.

Wetland impacts (due to fill placement in wetlands) that occurred under the implementation of the Interim Use Trail during 2003–2004 resulted in a loss of 0.11 acre in six low-functioning wetland areas, all located on top of the existing rail embankment (Parametrix 2001). Of the six areas, three small wetlands were filled entirely: Wetlands 16A, 29A, and 31B. Three other wetland areas have been filled completely or in part during adjacent development: Wetlands 35A and 35B and part of Wetland 28A. These areas are not discussed further in this report.

Due to natural or human-caused changes in wetlands, the project area has been periodically reevaluated for wetlands. During February and the summer months of 2002, Parametrix staff walked the King County right-of-way to review wetland boundaries determined in 1999 and 2000, assess functions of wetlands, and identify any areas that may meet the definition of wetland but had not been identified in the earlier field efforts. These revised wetland boundaries were estimated using field observations and digitized onto the project base maps. In January of 2003, Parametrix staff delineated new wetland boundaries in three locations in the study area (Wetlands 22C/D, Wetlands 24A/B, and Wetland 22A) and surveyed these areas. Minor adjustments were made to wetland areas based on this re-evaluation. For example, Wetlands 22C and 22D were originally delineated as two separate wetlands, divided by a small area of upland. In the 2003 re-evaluation, the area between the two wetlands was determined to have wetland hydrology (groundwater discharge from the adjacent toe of the road prism) and hydric soil indicators (Parametrix 2003b).

Changes to wetland conditions and boundaries by natural and human causes are reflected in the following information. Delineated boundary lines and estimated boundary lines are shown along with the proposed project designs in Appendices A and B.

2.4 WETLAND IDENTIFICATION AND DELINEATION

Potential wetland areas were evaluated in the field using the methods outlined in the *Corps of Engineers Wetland Delineation Manual* (Corps Manual) (Environmental Laboratory 1987) and the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997). According to these manuals, hydrophytic (wetland) vegetation, hydric (wetland) soils, and wetland hydrology must be present for an area to be a wetland. These methods provide procedures to evaluate areas year-round for wetland conditions, and thus determinations can usually be made during dry summer months when many wetlands lack water, or winter months when some plants may be absent.

Data used to evaluate wetland conditions were collected from areas that represented typical conditions in each wetland (Appendix G). Additional data collected in areas adjacent to wetlands documented the associated upland conditions. Delineated wetland boundaries were marked with survey flagging. Parametrix survey staff surveyed boundaries and the locations of data plots in December 1999, January and February 2000, and January 2003.

In many locations, the former railbed is paralleled by streams, wetlands, or drainage ditches. Ditches were considered to meet the wetland criteria and delineated as wetland if they were greater than 6 feet wide and if all three wetland criteria were present. They were also considered wetland if they were constructed in hydric soil. Ditches that were less than 6 feet wide and constructed in non-hydric soil were not considered to be wetlands.[7] Streams were distinguished from ditches and characterized according to the USFWS methods (Parametrix 2004c).

To assess the presence and type of wetlands and the approximate location of wetland boundaries occurring on adjacent private properties, Parametrix staff observed conditions from publicly owned right-of-ways. For wetlands on private property, the wetlands were identified using observations of wetland plants (such as Oregon ash, red osier dogwood [*Cornus sericea*], small-fruited bulrush [*Scirpus microcarpus*], and sedges [*Carex* spp.]), the presence of ponded water, and/or topography.

2.4.1 Vegetation

Following required analysis procedures (Environmental Laboratory 1987, Ecology 1997), the presence of wetland vegetation was determined. Dominant plant species were recorded for each wetland and percent canopy coverage was estimated in each data plot. Sampling plots were nested, circular plots with 2-meter, 4-meter, and 6-meter radii in which the coverage of herbaceous species, shrub species, and tree species, respectively, were measured. A wetland indicator status (Table 2-2) was then assigned to each dominant species based on the frequency of their occurrence in wetlands (Reed 1988, 1996, 1997). An area was considered to have a hydrophytic plant community when greater than 50 percent of the dominant plants were found to be facultative, facultative wetland, or obligate. Scientific and common plant names used in this report follow currently accepted terminology of the PLANTS database (USDA 2004).

[7] The centerlines of ditches were flagged with blue and white striped flagging for surveying.

Table 2-2. Definitions of Wetland Plant Indicator Categories

Category	Symbol	Definition
Obligate Wetland Plants	OBL	Plants that almost always (greater than 99 percent of the time) occur in wetlands, but which may rarely (less than 1 percent of the time) occur in non-wetlands.
Facultative Wetland Plants[a]	FACW	Plants that often (67 to 99 percent of the time) occur in wetlands, but sometimes (1 to 33 percent of the time) occur in non-wetlands.
Facultative Plants[a]	FAC	Plants with an equal likelihood (33 to 67 percent of the time) of occurring in both wetlands and non-wetlands.
Facultative Upland Plants[a]	FACU	Plants that sometimes (1 to 33 percent of the time) occur in wetlands, but occur more often (67 to 99 percent of the time) in non-wetlands.
Obligate Upland Plants	UPL	Plants that rarely (less than 1 percent of the time) occur in wetlands, and almost always (greater than 99 percent of the time) occur in non-wetlands.
Not Listed	NL	Plants not on the wetland indicator list.
Not Indicated	NI	Plants on the list, but insufficient information is available to determine indicator status.

Source: Reed 1988, 1996, 1997.

[a] Within the FACW, FAC, and FACU categories, a plus (+) or minus (-) sign specifies a relatively higher or lower probability, respectively, of a plant occurring in wetlands. Plants with FAC- indicator status are not considered to be wetland plants.

2.4.2 Soils

Hydric soils develop where soils are saturated, flooded, or ponded long enough to develop anaerobic and reducing conditions in the upper 12 inches of the soil profile. Hydric soils are typically recognized by examining surface horizons for low soil chroma, gleying, high organic matter content in the surface horizon, sulfidic odor, the presence of mottles, or other unique features (Environmental Laboratory 1987; Ecology 1997).

To determine whether hydric soils were present, staff evaluated soil conditions in pits dug to approximately 18 to 20 inches at each data plot location. The soil profile was analyzed for hydric indicators. Moist soil colors were determined using a Munsell Color Chart (Greytag Macbeth Corporation 1994). Parametrix project staff also estimated organic content, texture, and consistency by feel and determined if sulfidic material was present by smell.

2.4.3 Hydrology

Typically, an area has wetland hydrology when soils are saturated to the surface or inundated for at least two weeks during the growing season. For the central Puget Sound basin, the growing season is generally considered to be between late February and early December, based on dates during which a soil temperature greater than 41 degrees Fahrenheit [°F] is measured at 20 inches below the surface near Sea-Tac Airport Washington (Snyder et al. 1973). The delineations were generally performed during the winter months (the rainy season in the Pacific Northwest), which allowed a more accurate evaluation of wetland hydrology than can be made during other seasons.

Precipitation for the 1999–2000 water year (October through September) and the 2002–2003 water years were normal (based on data from 1994 through 2001 at Sea-Tac Airport). This indicates that hydrologic observations made during this study reflect typical conditions. [Primary wetland hydrology indicators (i.e., saturation or inundation) were present in all wetlands during delineations.]

All potential wetlands (areas of hydrophytic vegetation, hydric soils, depressions, stream margins, etc) were examined for positive indicators of wetland hydrology, including surface inundation, free-standing water in the soil pit, soil saturation, water marks on vegetation, water-stained leaves, cracked mud and biofilms, and oxidized root channels associated with living roots and/or rhizomes.

2.5 WETLAND RATINGS AND CLASSIFICATIONS

2.5.1 U.S. Fish and Wildlife Service Classification

Wetlands were classified according to the USFWS's *Classification of Wetlands and Deep Water Habitats of the United States* (Cowardin et al. 1979). These classifications are included with the detailed wetland descriptions presented in Appendix H.

2.5.2 Hydrogeomorphic Classification

Wetlands were also classified by the hydrogeomorphic (HGM) class (Brinson 1993), which relies on geomorphic setting and water source and transport. This organization was chosen because functions of the wetlands in the same class are similar (Table 2-3). Four HGM classes of wetlands occur in the study area, including two commonly recognized, natural classes (depressional closed and slope), and two classes that account for certain wetlands where development has altered water distribution and HGM class (modified slope and modified riverine).

Table 2-3. Summary of Potential Functions for Hydrogeomorphic Wetland Classes in the Study Area

Hydro-geomorphic Class	Flood Flow Alteration	Sediment Removal	Nutrient and Toxicant Removal	Erosion-Shoreline Stabilization	Production Export	Wildlife Habitat	Fish Habitat
Depressional Closed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slope	No	No	No	No	Yes	Yes	No
Modified Slope	Modified	Modified	Modified	Modified	Yes	Yes	No
Riverine	Modified	Yes	Yes	Modified	Yes	Yes	Yes

2.5.2.1 *Depressional*

Depressional wetlands are wetlands that form in topographic depressions with contours on at least three sides. Elevations within the wetland are lower than the surrounding landscape. They may have an outlet (depressional outflow) or not (depressional closed). Groundwater and precipitation are the major sources of hydrology. These wetlands can function to detain water.

2.5.2.2 *Slope*

Slope wetlands are wetlands that occur on hillsides or valley slopes, resulting in unidirectional, downgradient water flow. The principle water sources for slope wetlands are groundwater and/or precipitation. These wetlands do not have the ability to retain water and drain without observable bed or bank or constrained outlets. Historically, most slope wetlands in the study area drained directly to Lake Sammamish.

2.5.2.3 *Modified Slope*

Modified slope wetlands retain some of the native characteristics of slope wetlands but predominantly function like depressional class wetlands; they retain hydrologic dependence on groundwater discharge[8] and may have unidirectional flow like slope wetlands, but also detain water and convey it through a restricted outlet and may have a defined channel, similar to depressional outflow wetlands.

Many wetlands currently located along the east side of the former railbed or east of East Lake Sammamish Parkway were slope wetlands prior to development. These wetlands now concentrate discharge through culverts through road or rail embankment. These wetlands may or may not retain a hydrological connection to the lake in the form of surface flow-through culverts or ditches.

2.5.2.4 *Modified Riverine*

Riverine wetlands are wetlands that occur in floodplains and riverine corridors in association with streams or river channels. There are two subclasses: riverine flow-through and riverine impounding. Some riverine wetlands provide support for anadromous and/or resident fish species.

A large proportion of the riverine flow-through wetlands in the study area have been altered and only retain some of the natural riverine wetland functions and now function as depressional outflow wetlands. Due to development, floodplains and riparian corridors are discontinuous, as they are frequently eliminated by fill and culverts. Generally, these alterations have decreased the ability of these areas to function in providing fish habitat. To some degree, the wetlands retain the riverine characteristic of receiving overbank flooding during high stream flows. Many of these modified areas are associated with fish-bearing streams, while others do not provide fish habitat; thus the wetlands are grouped into modified riverine with fish and modified riverine without fish.

2.5.3 Regulatory Ratings

Wetlands were rated according to the *Washington State Wetlands Rating System, Western Washington* (Ecology 1993) (Appendix I) and local critical areas regulations. Wetlands in the city of Redmond were rated using the Redmond system (city of Redmond 1997), which classifies wetlands into four wetland types. Wetlands in the cities of Issaquah and Sammamish were rated according to their three-tier systems (city of Issaquah 1995; city of Sammamish 1999). Appendix J provides a detailed description of the regulatory framework for wetlands in the corridor. Buffer widths assigned to wetlands (Parametrix 2003a) reflect the requirements of the applicable local jurisdiction.

2.6 WETLAND FUNCTIONAL ASSESSMENT

Parametrix assessed the functions of each wetland qualitatively according to WSDOT agency guidelines and recommendations. The WSDOT *Wetland Functions Characterization Tool for Linear Projects* (Null et al. 2000) was used to record the presence of indicator characteristics for wetlands (Appendix K). This assessment tool was developed by WSDOT to characterize wetland functions in a consistent manner based on various physical and ecological wetland characteristics (Null et al. 2000). The method was developed and reviewed by a multiagency committee that included wetland specialists from the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, USFWS, WDFW, Washington State

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[8] Groundwater discharge refers to groundwater originating in upgradient areas that flows to and surfaces in a wetland.

Department of Ecology (Ecology), WSDOT, The Nature Conservancy, and the Muckleshoot Indian Tribe. The assessment tool is used to estimate wetland functions based on site-specific conditions and professional experience.

Wetland functions that were considered most relevant to this project were grouped into three broad categories: hydrologic functions, habitat support functions, and social values. Hydrologic functions assessed include flood flow alteration, sediment removal, nutrient/pollutant removal, and erosion control and shoreline stabilization. Habitat functions include organic matter production and export; general habitat suitability as well as aquatic invertebrate, amphibian, wetland-associated mammal, and wetland-associated bird habitat suitability; general fish habitat; and native plant richness. Social values assessed include the ability to provide “educational or scientific” value or “uniqueness and heritage” value.

In several instances where large wetlands extended east or west of the study area, the functional assessment was performed in portions of the wetland closest to the study area. This approach ensures that the functional assessment reflects the actual portion of the wetland that may be impacted by the project.

Detailed guidance for each of the functions assessed is provided in the *Wetland Functions Characterization Tool for Linear Projects* (Null et al. 2000). Parametrix staff assessed the presence of wetland functional indicators identified in Null et al. (2000) at each wetland during June and July 2002. The field data form from the WSDOT characterization tool was used to help organize the data recorded in a database using a field computer (Appendix K). Each function was then assigned a summary rating of low, moderate, or high based on the presence of the indicators.

2.7 BUFFER FUNCTIONAL ASSESSMENT

A buffer functional assessment was performed in January 2003 for wetland buffers of wetlands within the jurisdiction of the city of Sammamish. Buffers are defined as a zone located between a natural resource and adjacent areas subject to human alteration (Castelle et al. 1994). A buffer provides protection to the wetland’s ecosystem functions, including biological, chemical, and hydrologic properties. Characteristics of effective buffers are summarized in Table 2-4.

Field data sheets were used to record specific observations of wetland buffer conditions in the study area located within the city of Sammamish. The buffer data sheets allowed collection of consistent information regarding buffers.

Table 2-4. Characteristics of Effective Buffers

Aspect of Buffer Function	Primary Mechanisms or Processes	Factors	Characteristics of Effective Buffers
Water Quality Improvement Including sediment and contaminant removal (e.g., pesticides, petroleum products, metals, pathogens, and excess nutrients)	Settling of sediments via slowing surface water flows, infiltration to soil, physical filtration by vegetation, chemical sorption to soil, biochemical transformation/degradation in soil	Dependent upon sheet flow (verses concentrated channel flow) to buffer Residence time Soil infiltration rates	• Gentle slopes • Variable microtopography • Dense vegetation, including grassy areas and forests with dense understory • Organic debris on soil surface, such as woody materials and organic litter layers • Pervious soils with measurable water holding capacity • Buffer width of 50 to 100 feet
Microclimate Protection Water and air temperature attenuation	Shading Wind blockage Canopy coverage that intercepts radiation	Vegetation type, height, and density Slope	• Dense forest vegetation • Conifer overstory • Gentle to moderate slopes
Habitat Nesting, feeding, breeding, etc.	Cover Food Sources Den locations Specialized niches (snags, logs, tree canopy, open water, etc.; depends on species)	Vegetation strata Vegetation species and other food sources Presence of specialized niches	• Frequently dependent on condition of native vegetation • Highly variable and dependent on wildlife species requirements

Source: McMillan (2000).

3. AFFECTED ENVIRONMENT

Approximately 78 wetland systems have been identified as being in or directly adjacent to the study area. Wetlands in the study area are described in the following sections and summarized in Table 3-1. In the following sections, information on wetlands within the same HGM class is grouped together. To document wetland ratings and functional assessments, information on individual wetlands is summarized in this section. Appendix H and Appendix I provide additional supporting details. Detailed descriptions of size, hydrology, soil, and vegetation for individual wetlands are provided in Appendix H. Detailed information on individual wetland functions by HGM class is provided in Tables 3-2, 3-3, 3-4, 3-5, and 3-6. Wetlands were assigned a number sequentially as they were delineated (Parametrix 2000) and wetlands that form a single complex were some times delineated as separate wetlands; wetlands that make up a related complex are discussed together in Appendix H.

3.1 DEPRESSIONAL CLOSED WETLANDS

3.1.1 Description

Wetlands 8C and 18C are the only depressional closed wetlands in the study area. These wetlands are small, hydrologically isolated areas with no surface drainage. Both wetlands are approximately 0.04 acre in size and are vegetated with wetland shrubs or emergent vegetation. Prior to the building of the rail embankment, Wetland 18C likely functioned as a slope wetland draining directly to Lake Sammamish. Groundwater discharge[9] and precipitation are the principle sources of hydrology for both areas. Both depressional wetlands are rated as Category III (Ecology), and 3 (Sammamish) (Table 3-1; Appendix I).

3.1.2 Functions and Values

Both Wetlands 8C and 18C are depressional closed wetlands that collect groundwater and surface runoff from adjacent areas but lack surface water outlets. As shown in Table 3-2, very few of the functional assessment indicators are present in these wetlands, and thus they do not provide substantial functions. For example, because of their small size, the amount of water collected and stored is small and insignificant relative to storage capacities of Lake Sammamish and other areas. Seasonal groundwater elevations are high enough to discharge into these areas in the wettest parts of the year. Both wetlands are located low in the watershed, isolated from streams, and have small storage capacity and thus cannot influence flood flows. Habitat functions are limited by the small size of the wetlands, surrounding development, and lack of association with a waterbody.

3.2 SLOPE WETLANDS DRAINING DIRECTLY INTO LAKE SAMMAMISH

3.2.1 Description

This group of 16 wetlands has formed on slopes above the lakeshore and drain directly into the lake. Located on the west side of the rail embankment, the wetlands generally extend downslope and outside of the study area. They are rated by Ecology as Category I, II, and III, or Class 1, 2, and 3 by local regulations, depending on size and vegetation (Table 3-1; Appendix I). Groundwater discharge is the major source of hydrology to these wetlands.

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[9] Groundwater discharge refers to groundwater originating in adjacent upgradient areas that flows to and surfaces in a wetland.

Table 3-1. Summary of All Wetlands in the Study Area

Hydro-geomorphic Classification	Wetland Identification	Stream Association	Jurisdiction	USFWS Classification[a]	Ecology Wetland Rating[b]	Local Rating[c]	Total Area in Study Area (Acres)	Stationing[d]	
								South	North
Depressional Closed	8C	n/a	Issaquah	PEM	III	NR	0.037	128.4	129.7
	18C	n/a	Sammamish	PSS	III	3	0.038	328.1	329.0
Slope	4B/D	n/a	Issaquah	PEM	I	1	1.804	169.7	194.0
	15A	Unnamed	Sammamish	PEM	III	3	0.033	312.8	315.6
	19B	n/a	Sammamish	PEM	III	3	0.147	344.5	347.2
	20B	n/a	Sammamish	PEM	III	3	0.036	349.6	350.4
	21A	n/a	Sammamish	PEM	III	3	0.046	353.3	354.2
	21C	n/a	Sammamish	PEM	III	3	0.048	355.0	357.3
	23B	n/a	Sammamish	PEM	III	3	0.066	370.9	372.3
	24B	Pine Lake & #0155	Sammamish	PFO	II	2	0.411	376.7	382.1
	24D	n/a	Sammamish	PEM	III	3	0.030	385.1	385.7
	27A	Unnamed	Sammamish	PEM	III	3	0.144	428.3	430.5
	29C	Unnamed	Sammamish	PFO	III	2	0.058	448.9	450.5
	29B	n/a	Sammamish	PEM	III	NR	0.020	454.5	455.1
	31D[e]	#0143K	Sammamish	PFO	III	2	0.003	470.3	470.6
	33A	n/a	Sammamish	PFO	III	2	0.023	556.2	557.6
	34F	Unnamed	Sammamish	PEM	III	3	0.016	580.6	581.0
	34A	n/a	Redmond	PFO	I	I	0.662	598.2	618.8
Modified Slope	10C	n/a	Issaquah	PEM	III	3	0.117	102.0	104.6
	10B	n/a	Issaquah	PEM	III	3	0.054	111.3	112.5
	8A	n/a	Issaquah	PSS	III	3	0.238	123.8	129.8
	6A	n/a	Issaquah	PEM	III	3	0.155	141.7	144.1
	6B	n/a	Issaquah	PEM	III	3	0.086	142.3	144.3
	4E	n/a	Issaquah	PEM	III	3	0.693	173.6	196.6
	4F	n/a	Issaquah	PEM	III	3	0.065	197.3	200.0
	1A	n/a	Issaquah	PEM	III	3	0.135	197.2	200.1
	2A	n/a	Issaquah	PSS	III	3	0.042	202.4	203.3
	3C	n/a	Issaquah	PFO	III	2	0.167	206.6	209.7
	3D	Tributary to many springs	Issaquah	PFO	III	2	0.044	210.1	211.0

Table 3-1. Summary of all Wetlands in the Study Area (continued)

Hydro-geomorphic Classification	Wetland Identification	Stream Association	Jurisdiction	USFWS Classification[a]	Ecology Wetland Rating[b]	Local Rating[c]	Total Area in Study Area (Acres)	Stationing[d]	
								South	North
Modified Slope	3E	Many springs	Issaquah	PFO	III	2	0.034	212.6	213.9
(continued)	14A	Unnamed	Sammamish	PEM	III	3	0.096	216.0	218.4
	14B	n/a	Sammamish	PEM	III	3	0.020	217.6	218.5
	14C	n/a	Sammamish	PEM	III	3	0.032	218.7	220.0
	13A	n/a	Sammamish	PEM	III	3	0.455	222.0	231.9
	12A	n/a	Sammamish	PFO	III	2	0.114	239.5	241.5
	15B	Unnamed	Sammamish	PEM	III	3	0.018	313.0	313.8
	15C	Unnamed	Sammamish	PEM	III	3	0.067	314.0	316.2
	19A	n/a	Sammamish	PEM	III	3	0.040	345.1	347.5
	20A	n/a	Sammamish	PEM	III	3	0.044	350.2	352.5
	21B	n/a	Sammamish	PEM	III	3	0.056	353.1	354.3
	22A/B	Unnamed	Sammamish	PSS	III	3	0.419	358.5	364.3
	22C/D	n/a	Sammamish	PEM	III	NR	0.179	365.5	368.2
	23A	n/a	Sammamish	PFO	III	2	0.136	369.2	371.4
	28B	n/a	Sammamish	PEM	III	NR	0.020	433.3	433.8
	31C	n/a	Sammamish	PEM	IV	NR	0.018	481.9	482.5
	33B	n/a	Sammamish	PEM	III	NR	0.022	555.8	557.7
	34G	n/a	Sammamish	PEM	III	3	0.018	575.5	575.9
	34E	n/a	Sammamish	PEM	III	NR	0.021	588.3	589.3
	34B	n/a	Redmond	PEM	III	III	0.043	601.1	601.9
	34C/D	n/a	Redmond	PEM	III	III	0.166	610.5	616.1
Modified Riverine No Fish	7A	Trib #1 to North Fork Issaquah Creek	Issaquah	PSS	III	3	0.240	132.0	135.1
	8B	Trib #1 to North Fork Issaquah Creek	Issaquah	PSS	III	3	0.232	132.0	135.2
	4G	Trib #2 to Lk Sam	Issaquah	PEM	III	3	0.120	163.9	168.7
	21D	Unnamed	Sammamish	PEM	III	3	0.246	354.9	357.9
	25A	#0150A	Sammamish	PFO	III	2	0.245	396.8	400.0
	25B	#0150A	Sammamish	PSS	III	2	0.337	400.4	404.8
	28A[e]	Unnamed	Sammamish	PEM	III	3	0.098	445.7	447.5
	31A	#0143I	Sammamish	PEM	III	NR	0.032	487.7	488.8

Table 3-1. Summary of all Wetlands in the Study Area (continued)

Hydro-geomorphic Classification	Wetland Identification	Stream Association	Jurisdiction	USFWS Classification[a]	Ecology Wetland Rating[b]	Local Rating[c]	Total Area in Study Area (Acres)	Stationing[d]	
								South	North
Modified Riverine with Fish	9A	North Fork Issaquah Ck	Issaquah	PSS	III	2	0.091	117.7	119.9
	10A	North Fork Issaquah Ck	Issaquah	PFO	III	2	0.283	117.8	122.1
	9B	North Fork Issaquah Ck	Issaquah	PSS	III	2	0.078	120.6	122.8
	5A	Trib #1 to Lk Sam	Issaquah	PEM	III	2	0.871	145.6	157.0
	5B	Trib #1 to Lk Sam	Issaquah	PEM	III	2	0.384	145.8	159.6
	4A	Trib #1 to Lk Sam	Issaquah	PFO	III	2	0.445	163.7	169.3
	3A	Many Springs	Issaquah	PFO	III	2	0.192	204.2	206.6
	3B	Many Springs	Issaquah	PFO	III	2	0.628	207.0	213.7
	23C	Pine Lake & #0155	Sammamish	PFO	III	2	0.106	374.3	375.5
	24A	Pine Lake & #0155	Sammamish	PFO	II	2	0.555	376.2	382.3
	24C	Pine Lake & #0155	Sammamish	PFO	II	2	0.193	382.4	386.5
	25C	Ebright Creek	Sammamish	PSS	III	2	0.272	405.2	407.8
	25D	Ebright Creek	Sammamish	PEM	III	2	0.093	406.2	407.8
	25F	Ebright Creek	Sammamish	PSS	III	2	0.026	408.2	408.85
	26C	Zaccuse Creek	Sammamish	PEM	III	2	0.042	419.7	420.6
	26A	Zaccuse Creek	Sammamish	PFO	III	2	1.017	416.5	428.4
	30B	#0143L	Sammamish	PSS	III	3	0.258	456.8	461.0
	32A	#0143D	Sammamish	PSS	III	3	0.281	529.3	534.4
	32B	#0143D	Sammamish	PEM	III	3	0.182	534.5	538.5
	Bear Creek area wetlands	Bear Creek	Redmond	PEM	NR	NR	0.156	677.2	679.0

n/a = not applicable NR = not rated

[a] These classifications reflect predominant wetland condition, which may vary from conditions within the King County right-of-way. Data sheets in Appendix G indicate wetland community type sampling locations.

[b] According to Ecology (1993).

[c] See Appendix J for definitions.

[d] Corridor Alternative stationing.

[e] Adjacent property owners have submitted information to the city of Sammamish indicating that some or all of this area is not wetland.

Table 3-2. Functions Assessment of Depressional Closed Wetlands in the Study Area

Function/Value	Occurrence	Indicators Present	Comments
Flood flow alteration	No	None	No opportunity to provide this function.
Sediment removal	No	None	No streams or sediment sources flow in these wetlands.
Nutrient and pollutant removal	No	None	No opportunity to provide this function. No streams connected to the wetlands.
Erosion control and shoreline stabilization	No	None	No opportunity to provide this function. There are no stream or lake connections to these wetlands.
Production of organic matter and its export	No	None	No opportunity to provide this function. Areas lack surface flow.
General habitat suitability	No	None	None of the characteristics are present. Areas are surrounded by development.
Habitat for aquatic invertebrates	Yes	1, 5	Low. Wetlands have standing water in the winter and some habitat cover suitable for invertebrates. Area is small with no upland connection.
Habitat for amphibians	Yes	1, 4	Low. Areas have standing water in the winter, but lack most other necessary characteristics.
Habitat for wetland-associated mammals	No	None	No opportunity to provide this function because no indicators are present.
Habitat for wetland-associated birds	No	None	No opportunity to provide this function because no indicators are present.
General fish habitat	No	None	No opportunity to provide this function.
Native plant richness	Yes	1	Low. Dominant vegetation are native shrubs and nonnative grasses.
Educational or scientific value	No	None	The small wetlands are impacted by adjacent development.
Uniqueness and heritage	No	None	No indicators present.

Wetlands 4B/D and 34A are Class I Wetlands located in Sammamish State Park and Marymoor Park. These wetlands occur outside of the right-of-way, with the right-of-way forming their eastern boundary.

Wetland 24B is one of the larger slope wetlands, and it is associated with two fish-bearing streams, Pine Lake Creek and Stream Number 0155. The wetland also includes a wetland enhancement area with a small pond.

The five forested wetlands in this group (see Table 3-1) are dominated by red alder (*Alnus rubra*), black cottonwood, and Oregon ash trees. Salmonberry, ninebark (*Physocarpus capitatus*), and red osier dogwood are common understory shrubs. The emergent wetlands in this group are mowed turf or dominated by weedy vegetation that results from frequent disturbance.

The hydrology in these wetlands is dominated by groundwater discharge. Surface water runoff and precipitation appear to contribute only limited amounts of water to wetland hydrology and would not be capable of maintaining soil saturation during the drier months.

3.2.2 Functions

Slope wetlands can provide a variety of functions. In a natural state, they can provide habitat support to lake biota through the production and export of organic material. However, this function, as well as wetland habitat functions, is constrained wherever management practices result in lawn or low-quality weedy vegetation (Table 3-3). The lawn areas adjacent to the lake do provide some grazing habitat to ducks and Canada geese.

Some slope wetlands that directly border the lakeshore can provide shoreline stabilization. However, the areas that do provide this function are limited by their small size.

General habitat suitability ratings are low for the all the wetlands except Wetland 24B, which is rated moderate for habitat. The habitat functions of the wetlands are limited because they are dominated by turf or weedy vegetation types that do not provide habitat functions and because they are small areas surrounded by development.

Slope wetlands by definition do not provide flood flow alteration because they are not able to retain water. Three of the wetlands have associated streams that could provide external sources of sediments and nutrients; of these three, only Wetland 24B may provide sedimentation or nutrient transformation functions.

Table 3-3. Functions Assessment of Slope Wetlands in the Study Area

Function/Value	Occurrence	Indicators Present	Comments
Flood flow alteration	No	for Wetland 24B only: 2, 5, 6	All wetlands are unable to provide this function except Wetland 24B. Wetland 24B is rated low because inlets are constrained and development had reduced the extent that wetland interfaces with streams.
Sediment removal	No	None	Not able to provide this function. Wetland 24B provides moderate function due to drainage and vegetation.
Nutrient and pollutant removal	No	None	Not able to provide this function. Wetland 24B provides moderate function due to drainage and vegetation.
Erosion control and shoreline stabilization	Yes	1, 2, 3	Moderate for Wetlands 24B, 29C, 31D, and 33A because these are relatively well-vegetated areas.
Production of organic matter and its export	Yes	2, 6	Moderate for wetlands 24B, 29C, 31D, and 33A. These are well-vegetated forested areas.
General habitat suitability	No	None except for 24B: 5	No suitable habitat provided. Only Wetland 24B has low general suitability because it contains a small area of open water, two streams, and forested area draining to the lake.
Habitat for aquatic invertebrates	Yes	1, 2, 3, 4, 5, 6	This function is potentially provided along the lakeshore. Low for wetlands with turf. Moderate for the forested wetlands that provide organic inputs and shade to the lake shore. Wetland 24B rates moderate.
Habitat for amphibians	Yes	1, 2, 4, 6	This function is potentially provided along the lakeshore but is limited within the study area for all wetlands. Low for wetlands with turf or with hardened shorelines. Moderate for the forested wetlands.
Habitat for wetland-associated mammals	Yes	1, 2, 3, 7	Low. While the connection to the lake should provide opportunities for this function, there is no interspersion of vegetation and open water in the study area. The adjacent areas are developed.
Habitat for wetland-associated birds	Yes	1, 2, 3	Low. Ducks and geese use the areas with turf.
General fish habitat	Yes	1, 2, 3, 4,	Moderate to low. The forested wetlands provide support though cover, some shading, and organic inputs. The small wetland areas and lack of vegetation diversity limit this function. The wetlands with turf or hardened shorelines are low for this function.
Native plant richness	Yes	1, 2	Moderate to low. Native trees and shrubs are present in the forested wetlands. The wetlands with turf have very few native plants.
Educational or scientific value	Yes	2	Low. These are small areas impacted by adjacent development.
Uniqueness and heritage	Yes	2	Low. Some value is provided by the forested wetlands simply because they are increasingly rare along the lake.

3.3 MODIFIED SLOPE WETLANDS

3.3.1 Description

Modified slope wetlands occur where development (typically railbed construction) has altered natural drainage patterns and slope. These modified areas function as depressional outflow wetlands. At several locations in the study area, wetlands occur where groundwater discharges along slopes. These areas have been modified by adjacent development and function more like depressional outflow wetlands than natural slope wetlands.

The 32 wetlands in this group are usually contained within the study area. Most are rated as Class 3 wetlands (local jurisdictions) unless they are too small to be rated by the local jurisdiction. Five wetlands have forested vegetation and are therefore rated as Class 2 wetlands (see Table 3-1; Appendix I). All are rated as Ecology III. Some of the areas have significant concave topography that can detain water, while other areas have flatter configurations that drain to interception ditches and do not have the capacity to hold deep water.

These wetlands typically support emergent vegetation; reed canarygrass is the most common species present. Five wetlands have young forest overstory composed of red alder, black cottonwood, and common Pacific willow (*Salix lasiandra*) shrubs and trees. Three wetlands support shrub vegetation largely composed of willow (*Salix* spp.), red alder saplings, red osier dogwood, and twinberry (*Lonicera involucrata*).

Wetland hydrology results from groundwater discharge, which is often supplemented by runoff, including stormwater runoff from East Lake Sammamish Parkway.

3.3.2 Functions

By definition, slope wetlands rely on groundwater discharge to provide wetland hydrology. The wetlands in this group have characteristics typical of slope wetlands but also have some characteristics of depressional wetlands because modified topography and constructed outlets allow water to be detained and channeled before draining to the lake (Table 3-4).

3.4 MODIFIED RIVERINE WETLANDS ASSOCIATED WITH FISH-BEARING STREAMS

3.4.1 Description

Twenty of the wetlands in the study area are associated with fish-bearing streams (WDFW Type 2 or 3 streams). These wetlands are rated as Category II or III (Ecology) and Class 2 or 3 (local jurisdiction) based on area and habitat features and other characteristics (see Table 3-1; Appendix I). They range in size from about 0.03 to 1.0 acre within the study area and most are largely linear, trough-shaped features. For most of these wetlands, the associated streams drain into the wetland and exit in the same general vicinity; thus stream and wetland interfaces are of limited area.

Table 3-4. Functions of Modified Slope Wetlands in the Study Area

Function/Value	Occurrence	Indicators Present	Comments
Flood flow alteration	No	None	None. The source of water is groundwater discharge. Most of these areas are slopes.
Sediment removal	No	None	No opportunity to provide this function. No sediment inflow from upslope areas.
Nutrient and pollutant removal	No	None	No opportunity to provide this function. Limited impacts from outside.
Erosion control and shoreline stabilization	No	None	No opportunity to provide this function. These areas are not associated with streams or the lake.
Production of organic matter and its export	Yes	1, 2, 6	Low. Water flows draining the wetlands are too small to transport significant amounts of organic matter.
General habitat suitability	No	None	None of the characteristics are present. Areas are surrounded by development.
Habitat for aquatic invertebrates	No	None	No opportunity to provide this function. Only small amounts of standing water are seasonally present
Habitat for amphibians	No	None	No opportunity to provide this function. Wetlands lack proper vegetation.
Habitat for wetland-associated mammals	No	None	No opportunity to provide this function. Wetlands are surrounded by development.
Habitat for wetland-associated birds	No	None	No opportunity to provide this function.
General fish habitat	No	None	No opportunity to provide this function.
Native plant richness	Yes	1	Low. Dominant vegetation is reed canarygrass for the emergent wetlands. For the 8 shrub and forested areas, small numbers (2 to 6) of common native species are present in each.
Educational or scientific value	No	None	These are small areas impacted by adjacent development.
Uniqueness and heritage	No	None	Not identified.

Forested, emergent, and scrub-shrub vegetation classes are present in these wetlands. Forested vegetation includes Oregon ash, black cottonwood, and red alder. Shrub vegetation is generally composed of young Pacific willow along with red osier dogwood, pea fruit rose (*Rosa pisocarpa*), and Himalayan blackberry. Also present in smaller numbers are other willow shrubs and Oregon ash saplings. Emergent vegetation most commonly consists of reed canarygrass, lady fern (*Athyrium filix-femina*), soft rush (*Juncus effusus*), giant horsetail (*Equisetum telmateia*), scouring rush (*Equisetum hyemale*), and small-fruited bulrush are locally dominant. Cattail (*Typha latifolia*) occurs in the center of some of the ditches or wettest areas. Limited areas of shrub vegetation including Douglas spirea (*Spiraea douglasii*) are also present. At many locations, significant vegetation disturbances (trimming, clearing, or mowing) have reduced vegetation cover. In addition, dumped yard waste, construction debris, and other trash have degraded many of these wetlands.

Saturated soil and surface water is maintained in these wetlands through seasonal processes. A seasonally high groundwater table is typically present, but overbank flow and surface runoff also function to some extent to provide wetland hydrology in each of these wetlands. Overbank flow during winter storms causes these areas to have areas of shallow standing water in the winter months.

3.4.2 Functions

In their native state, this group of wetlands would match the riverine HGM class, with substantial physical and ecological interactions between meandering streams and the associated wetlands. All of these areas have topography that is defined by the former railbed, parkway, and/or adjacent development. Surface water flows are typically constrained by the embankment and culverts. In addition, the wetlands no longer interact directly with the streams for any significant distance. While typical riverine functions, such as shading and organic matter export, are present, they are greatly limited (Table 3-5).

Typically, an important natural function of this group of wetlands is indirect support of fish habitat in the associated streams, but these modified wetlands provide this function at reduced levels and do not directly provide fish habitat. Other habitat support functions include some invertebrate production, organic matter production, and water quality improvement through sediment trapping and nutrient cycling, but these are limited by the small size of the wetlands.

Hydrologic functions include stormwater storage and minor base flow support. The areas receive sediment from upstream areas. Sedimentation is sometimes excessive, and wetland vegetation is often buried in the vicinity of the streams. The sediment accumulations necessitate frequent maintenance to keep the culverted outlets open and maintaining flows.

3.5 MODIFIED RIVERINE WETLANDS ASSOCIATED WITH NON-FISH-BEARING STREAMS

3.5.1 Description

Eight of the wetland in the study area are associated with streams that do not provide habitat for fish (WDFW Type 4 or 5 streams). These streams originate east of East Lake Sammamish Parkway and flow through the wetlands. Streams 0143I and 0150 are piped from the study area directly to the lake (associated with Wetlands 31A, 25A, and 25B). One unnamed stream drains to a series of storm ponds and finally to North Fork Issaquah Creek (associated with Wetlands 7A, 8A, and 8B). The wetlands are rated as Category II or III (Ecology) and Class 2 or 3 (local jurisdictions) depending upon size and the number of vegetation classes present (see Table 3-1; Appendix I).

These wetlands are predominantly of the scrub-shrub vegetation class and are generally vegetated with young Pacific willow along with twinberry, pea fruit rose, and red osier dogwood. Reed canarygrass and Himalayan blackberry are common on the slopes. Also occasionally present are other willow shrubs and Oregon ash saplings. Emergent vegetation is most commonly reed canarygrass with yellow iris (*Iris pseudacorus*), soft rush, giant horsetail, scouring rush, and small-fruited bulrush locally dominant. Like other wetlands in the study area, significant vegetation disturbances (trimming, clearing, or mowing) has reduced vegetation cover. In addition, dumping of yard waste, construction debris, and other trash occurs.

A seasonally high groundwater table is the most important source of hydrology, although overbank flow and surface runoff also provide water to the wetlands. Overbank flow during winter storms causes these areas to have areas of shallow standing water in the winter months.

Table 3-5. Functions of Modified Riverine Wetlands Associated with Fish-Bearing Streams

Function/Value	Occurrence	Indicators Present	Comments
Flood flow alteration	Yes	2, 3, 4, 6	Low to moderate. Generally, these areas have confined outlets and depressional topography that retains some overbank flow. However, these are located low in the watershed and the available storage area is small.
Sediment removal	Yes	1, 2, 5, 6	Moderate. These areas have many of the characteristics for this function and many associated streams supply excess sediment. However, this function results in repeated burial of wetland vegetation that ultimately results in a reduction of this function. Due to the small size of most wetlands and relatively high sediment loads, the capacity to store sediments is often exceeded, resulting in the need to excavate portions of the stream to maintain flow.
Nutrient and pollutant removal	Yes	1, 2, 3, 4	Moderate. Many of the characteristics involved in this function are present. Sources include adjacent development. The potential treatment area is small.
Erosion control and shoreline stabilization	Yes	2, 3	Moderate. Vegetation along stream banks provides some erosion control.
Production of organic matter and its export	Yes	1, 2, 5, 6	Moderate. This is limited by the lack of vegetation near the channel. The streams provide outlets for export to the lake.
General habitat suitability	Yes	5	Low. The wetlands are fragmented by development and the surrounding upland buffer is developed. There is low interspersion of wetland classes and limited connections to adjacent habitat. Disturbance from adjacent development is common.
Habitat for aquatic invertebrates	Yes	1, 2, 3, 6	Moderate to low. The streams themselves provide aquatic habitat. In the wetland, seasonal inundation is present but this function is limited by the lack of a variety of water depths and little or no suitable vegetation.
Habitat for amphibians	Yes	1, 6	Low. Little or no suitable vegetation is present. Woody debris is generally lacking.
Habitat for wetland-associated mammals	Yes	1	Low. Habitat conditions and adjacent development make them unsuitable for most species. The adjacent surroundings are developed.
Habitat for wetland-associated birds	Yes	2, 6	Low. Only very limited areas of open water associated with the streams are present, and surrounding areas are developed.
General fish habitat	Yes	1, 2, 3, 4	Moderate. The streams provide fish habitat, and the adjacent wetland areas provide indirect habitat support through cover, some shading, and organic inputs. The small areas and lack of vegetation diversity limit this function.
Native plant richness	Yes	1, 2	Low. While reed canarygrass is most prevalent, a limited number of various native shrubs are also present.
Educational or scientific value	Yes	2	Low. These are small areas impacted by adjacent development. In some seasons, fish can be observed from the rail embankment.
Uniqueness and heritage	Yes	2	Low. There is little opportunity to provide this function.

3.5.2 Functions

These wetlands generally provide the same functions identified for the riverine HGM class. This group of wetlands provides some habitat support functions, including limited invertebrate production, such as organic matter production and export and water quality improvement through sediment trapping and nutrient cycling (Table 3-6). Other habitat functions are very limited.

Hydrologic functions provided by the wetlands include stormwater and floodwater storage and minor amounts of base flow support. In some wetlands, significant vegetation disturbances (trimming, clearing, or mowing) have reduced vegetation cover, limiting habitat, organic matter production, and organic matter export functions. In addition, the dumping of yard waste, construction debris, and other trash degrades many of these wetlands.

Table 3-6. Functions of Modified Riverine Wetlands Associated with Non-Fish-Bearing Streams

Function/Value	Occurrence	Indicators Present	Comments
Flood flow alteration	Yes	2, 3, 4, 6	Low to moderate. These wetlands have confined outlets and depressional topography that does retain some overbank flow; water arrives primarily as channel flow. The areas are small and located low in the watershed.
Sediment removal	Yes	1, 2, 5, 6	Low. These areas have many of the characteristics for this function, and excess sediment is supplied by the associated streams. Burial of vegetation undermines this capability.
Nutrient and pollutant removal	Yes	1, 2, 3, 4	Low. Many of the characteristics for this function are present. Sources include adjacent development. The available wetland area is small, and deep recent sediment deposits impede some aspects of this function.
Erosion control and shoreline stabilization	Yes	2, 3	Moderate. Vegetation along stream banks provides some erosion control.
Production of organic matter and its export	Yes	1, 2, 5, 6	Low. This is limited by the lack of dense riparian vegetation. Organic matter entering streams is exported to the lake.
General habitat suitability	Yes	5	Low. The wetlands are fragmented by development, and the surrounding upland is developed. There is low interspersion of wetland classes and limited habitat connections to adjacent habitat. Disturbance from adjacent development is common.
Habitat for aquatic invertebrates	Yes	1, 2, 3, 6	Low. Seasonal inundation is present, but this function is limited by hydrologic conditions, sedimentation, and other necessary habitat features.
Habitat for amphibians	Yes	1, 6	Low. Vegetation and hydrologic conditions are not suitable for aquatic breeding species. No woody debris is present generally.
Habitat for wetland-associated mammals	Yes	1	Low. No interspersion of vegetation and open water. The adjacent surroundings are developed.
Habitat for wetland-associated birds	Yes	2, 6	Low. Suitable hydrologic and habitat conditions are absent.
General fish habitat	No	None	There is no opportunity to provide this function.
Native plant richness	Yes	1, 2	Low. Reed canarygrass is most prevalent; a variety of native shrubs are also present in limited amounts.
Educational or scientific value	Yes	2	Low. These are small areas impacted by adjacent development.
Uniqueness and heritage	No	None	There is little opportunity to provide this function.

4. IMPACT ASSESSMENT

4.1 INTRODUCTION

The following sections provide information on the impacts of the Master Plan Trail alternatives to wetlands and wetland buffers. This assessment evaluates potential loss of wetland and buffer area and function based on the amount of clearing, filling, and/or excavation proposed in each of the alternatives. Potential direct and indirect impacts due to construction and operation, including those that are temporary or long-term in duration, are considered for each alternative. This analysis also discusses potential cumulative impacts that may result from this project and other nearby, unrelated projects. In the sections below, impacts to wetlands are summarized by corridor alternative (Table 4-2), by Cowardin Class (Table 4-3), and by HGM Class (Table 4-4). Impacts are also shown on the plan drawings for each corridor alternative in Appendices A and B.

4.1.1 What Are Impacts?

Wetland impacts include the direct filling of wetlands by the project and indirect (or secondary) impacts that would result from altering wetland conditions without filling or otherwise eliminating them (Table 4-1). When evaluating the potential impacts of a project on wetlands, several factors must be considered; these include location, intensity, and duration. The various actions related to a project, including those during its construction, operation, and maintenance phases, can directly affect wetlands and buffer areas. The most common permanent effects to wetlands and wetland buffers are loss of area caused by filling and loss of vegetation. Direct impacts also include impacts that occur during construction. Indirect (also called secondary) impacts are caused by project actions that do not affect wetlands or buffers directly but lead to changes in wetland and/or buffer function. These impacts are typically permanent or reoccurring impacts, which usually occur during operation and maintenance.

Table 4-1. Categories of Potential Wetland Impacts

Permanent	
Direct	Loss of wetland area due to filling
	Alteration of wetlands due to clearing
Indirect	Impacts to water quality and quantity
Temporary	
Direct	Vegetation removal/disturbance during construction
	Construction noise and disturbance to wetland-associated wildlife
	Sedimentation/runoff from construction area
Indirect	Increased stormwater runoff from impervious surfaces, including equestrian uses
	Drainage system maintenance repair, including sedimentation and runoff
	Impacts to vegetation resulting from vegetation management
	Impacts to wetland-associated wildlife from human and pet presence and noise

4.1.2 How Impacts Were Evaluated

4.1.2.1 *Direct Impacts*

The areas of direct permanent impacts to wetlands and their buffers were determined electronically using a Geographic Information System (GIS). The footprint of each trail alternative was mapped on maps of surveyed wetland boundaries and estimated buffer locations (see Appendices A and B for these proposed designs). The areas where the two intersected were determined to be the area of direct project impact to wetlands and buffers.

The base maps used for this mapping were derived from aerial photographs (Walker 1998) and provide information on the topography and built environment of the study area. Estimates of the area of impacted wetlands have been developed based on a three-dimensional depiction of the alternative trail designs. Estimates of the area of impacted wetland buffers were developed by calculating the existing wetland buffer areas that lie within 10 feet of the centerline of the existing rail bed.

4.1.2.2 *Indirect Impacts*

Probable indirect impacts to wetland functions were estimated by considering how each alternative would alter wetland or buffer conditions in a manner that could alter wetland functions. This assessment was largely based on evaluation the project impacts to the various indicators of wetland function (see Appendix K and Section 3). Professional experience was also used to estimate the likely effects of proposed project actions on wetland functions by considering the changes to wetland conditions caused by the project, how these changes alter the quality of function of a wetland, and the extent of historical modifications that may have reduced or eliminated functions.

4.1.3 Summary of Direct Impacts by Project Alternative

As described in Section 1, six alternatives are under evaluation for the East Lake Sammamish Master Plan Trail. These are:

1. No Action Alternative
2. No Trail Alternative
3. Continuation of the Interim Use Trail Alternative
4. Corridor Alternative
5. East A Alternative
6. East B Alternative

The direct wetland and buffer impacts are summarized in Tables 4-2 through 4-4 and discussed further in this section. No direct impacts to wetlands or buffers would occur under the No Action Alternative, No Trail Alternative, or Continuation of the Interim Use Trail Alternative. Direct impacts to wetlands are estimated to affect approximately 1.04 acres for the Corridor Alternative and 1.19 acres for the two East Alternatives (Tables 4-2 and Table 4-3).[10] The impact to each wetland for the Corridor and East Alternatives is listed in Table 4-4.

[10] The impacts of the East A Alternative and East B Alternative to wetlands and wetland buffers are the same.

Table 4-2. Potential Direct Wetland Impacts Summarized by Alternative

Hydrogeomorphic Wetland Class	Continuation of the Interim Use Trail (Acres)	Corridor Alternative (Acres)	East Alternatives (Acres)
Closed Depression	0.00	<0.01	<0.01
Slope	0.00	0.20	0.18
Modified Slope	0.00	0.40	0.52
Modified Riverine without Fish	0.00	0.08	0.06
Modified Riverine with Fish	0.00	0.36	0.42
Total	**0.00**	**1.04**	**1.19**

Table 4-3. Potential Direct Wetland Impacts (in Acres) by the Corridor Alternative or by the East Alternatives, Arranged by USFWS Wetland Classification and Local Jurisdiction

USFWS Wetland Classification	Build Alternatives	Local Jurisdiction			
		Issaquah	Redmond	Sammamish	Total
PEM	Corridor Alternative	0.41	0.04	0.17	**0.62**
	East Alternatives	0.41	0.04	0.19	**0.65**
PSS	Corridor Alternative	0.03	0.00	0.05	**0.08**
	East Alternatives	0.03	0.00	0.11	**0.14**
PFO	Corridor Alternative	0.12	0.00	0.21	**0.33**
	East Alternatives	0.10	0.00	0.30	**0.40**
	Total Corridor Alternative	**0.56**	**0.04**	**0.43**	**1.04**
	Total East Alternatives	**0.54**	**0.04**	**0.61**	**1.19**

Table 4-4. Potential Wetland Impacts by HGM Classification for the Corridor Alternative and the East Alternatives

HGM Wetland Class	Wetland Identification	Corridor Alternative (Acres)	East Alternatives (Acres)
Depressional Closed	18C	0.00	0.00
	8C	<0.01	<0.01
Total		**<0.01**	**<0.01**
Slope	15A	0.00	0.00
	19B	0.00	0.00
	20B	<0.01	0.00
	21A	0.00	0.00
	21C	0.00	0.00
	23B	0.00	0.00
	24B	0.06	0.06
	24D	<0.01	<0.01
	27A	0.00	0.00
	29B	0.01	0.00
	29C	0.00	0.00
	31D[a]	0.00	0.00

Table 4-4. Potential Wetland Impacts by HGM Classification for the Corridor Alternative and the East Alternatives (continued)

HGM Wetland Class	Wetland Identification	Corridor Alternative (Acres)	East Alternatives (Acres)
	33A	0.00	0.00
	34A	0.00	0.00
	34F	0.00	0.00
	4B/D	0.12	0.12
Total		**0.19**	**0.18**
Modified Slope	10B	0.00	0.00
	10C	0.04	0.04
	12A	<0.01	0.03
	13A	<0.01	0.04
	14A	0.01	0.01
	14B	0.00	0.00
	14C	<0.01	<0.01
	15B	0.00	0.00
	15C	<0.01	0.00
	19A	<0.01	0.00
	1A	0.03	0.03
	20A	0.02	0.00
	21B	0.01	0.00
	22A/B	<0.01	0.04
	22C/D	<0.01	0.05
	23A	<0.01	0.02
	28B	0.00	<0.01
	2A	0.00	0.00
	31C	<0.01	<0.01
	33B	<0.01	0.02
	34B	<0.01	0.01
	34C/D	0.03	0.03
	34E	<0.01	<0.01
	34G	0.00	0.00
	3C	0.02	0.00
	3D	<0.01	0.02
	3E	0.02	0.02
	4E	0.10	0.10
	4F	0.03	0.03
	6A	<0.01	<0.01
	6B	0.01	0.01
	8A	0.01	0.01
Total		**0.40**	**0.52**
Modified Riverine With Fish	10A	0.00	0.00
	23C	<0.01	0.04
	24A	0.07	0.08
	24C	0.02	0.03

Table 4-4. Potential Wetland Impacts by HGM Classification for the Corridor Alternative and the East Alternatives (continued)

HGM Wetland Class	Wetland Identification	Corridor Alternative (Acres)	East Alternatives (Acres)
	25C	0.02	0.02
	25D	0.01	0.01
	25F	0.00	0.00
	26A	0.05	0.08
	26C	0.00	0.00
Modified Riverine With Fish (continued)	30B	<0.01	0.00
	32A	<0.01	<0.01
	32B	0.02	0.02
	3A	0.00	0.00
	3B	0.03	0.01
	4A	0.05	0.05
	5A	0.04	0.04
	5B	0.01	0.01
	9A	0.00	0.00
	9B	<0.01	<0.01
	Bear Cr	<0.01	<0.01
Total		**0.36**	**0.42**
Modified Riverine Without Fish	21D	0.02	0.00
	25A	0.00	<0.01
	25B	<0.01	<0.01
	28A[a]	0.01	0.02
	31A	0.01	0.01
	4G	0.02	0.02
	7A	<0.01	<0.01
	8B	<0.01	<0.01
Total		**0.08**	**0.06**
Grand Total		**1.04**	**1.19**

[a] Adjacent property owners have submitted information indicating that some or all of this area is not wetland.

4.2 IMPACTS FROM THE NO ACTION ALTERNATIVE

Under the No Action Alternative, operation of the Interim Use Trail would continue through 2015. No construction would be required. Operational impacts would be the same as those discussed in the Interim Use Trail EIS (Parametrix et al. 2000a,b). King County would continue to maintain the existing drainage facilities, including culverts and ditches. Potential effects of these maintenance activities have been discussed in the Interim Use Trail EIS (Parametrix et al. 2000a,b) and would not change.

4.3 IMPACTS FROM THE NO TRAIL ALTERNATIVE

Under the No Trail Alternative, it is anticipated that decommissioning would occur as early as 2006. Decommissioning steps would involve removing trail signage, fencing, etc., but the gravel surfacing would not be disturbed.

4.3.1 Direct Permanent Impacts from Decommissioning

No substantial filling, clearing, or grading is anticipated to result from decommissioning; thus no direct permanent impacts to wetlands or wetland buffers are anticipated.

4.3.2 Direct Temporary Impacts from Decommissioning

Decommissioning would include removal of trail signposts and potential removal of fences adjacent to wetlands. These activities could result in minor disturbances to herbaceous vegetation in the right-of-way and minor filling of post holes. These impacts would be temporary and not expected to alter any wetland or buffer function.

4.3.3 Indirect Impacts from Decommissioning

4.3.3.1 *Impacts to Water Quality and Quantity*

Decommissioning of the Interim Use Trail would not result in any changes to wetland conditions that would affect the hydrologic functions of wetlands or water quality. Substantial disturbances to vegetation or drainage features would not occur. Eliminating trail uses would not alter the ability of wetlands or buffers to provide water quality or quantity functions because soil, topographic, and vegetation conditions would not change.

Railbanking requires that the King County right-of-way be maintained, and under decommissioning, King County would continue to maintain the existing drainage facilities, including culverts and ditches. Potential effects of these maintenance activities have been discussed in the East Lake Sammamish Interim Use Trail EIS (Parametrix et al. 2000a,b) and would not change. Under this alternative, some vegetation management activities may cease, and greater amounts of shrubs or forest vegetation may ultimately colonize the King County right-of-way. This trend could result in minor, positive benefits to wetland water quality functions.

4.3.3.2 *Impacts to Wetland-Associated Wildlife*

Wildlife use of wetlands and wetland buffers is currently limited because the available wildlife habitat is highly fragmented by urban development, and the habitat quality is generally low. Most species within the study area are adapted to urban settings and their associated noise and presence of humans and pets.

Thus discontinuing the Interim Use Trail is not likely to affect wildlife use because habitat conditions would remain unchanged. Under this alternative, some vegetation management activities may cease and somewhat greater amounts of tree and shrub vegetation may establish in the right-of-way. This condition would be a minor benefit to some urban-adapted wildlife.

4.4 IMPACTS FROM THE CONTINUATION OF THE INTERIM USE TRAIL ALTERNATIVE

4.4.1 Direct Permanent Impacts

Continuation of the Interim Use Trail Alternative would not result in wetland or buffer impacts for trail development because the trail, in the vicinity of all wetlands, would remain unchanged from the Interim Use Trail. North of SR 520, additional gravel would be laid on the former railbed to extend the trail across Bear Creek to Redmond. No new wetland or buffer impacts would occur in this vicinity.

New parking and restroom facilities would necessitate new construction in three areas. These locations are completely removed from wetlands and wetland buffers, and direct permanent impacts to wetlands or wetland buffers would not result from filling and vegetation removal for the facilities.

4.4.2 Direct Temporary Impacts

Temporary impacts to wetlands and wetland buffers would not occur during the construction of the parking facility and restroom facilities because they are not located in or near wetlands.

4.4.3 Indirect Impacts

4.4.3.1 *Impacts to Water Quality and Quantity*

As part of the Continuation of the Interim Use Trail Alternative, parking and restroom facilities would be constructed. Indirect impacts to wetlands from these facilities are not anticipated because the runoff from the new impervious surfaces would be treated in stormwater management facilities. Stormwater management facilities would include water quality treatment and quantity control facilities to reduce potential impacts of the new surfaces. The new parking and restroom areas are not located in wetlands or buffers, and wetland impacts would not occur.

Under this alternative, the drainage system in the King County right-of-way, which is composed of ditches and culverts, would continue to be maintained. This maintenance and repair of ditches and culverts could result in temporary sedimentation and vegetation disturbance. Currently for the operation of the Interim Use Trail, best management practices (BMPs) are employed to protect water quality and wetlands, and these practices would be continued under the Continuation of the Interim Use Trail Alternative. Potential sedimentation during ditch maintenance would be minimized by performing ditch maintenance in the dryer time of the year, using check dams, and implementing sediment control measures. Temporary disturbance of vegetation would be minimized and limited to the area between the trail alignment and drainage ditch, and within the ditch itself. Reed canarygrass would be the most commonly disturbed vegetation, and since this plant provides poor wildlife habitat, substantial impacts would not occur.

Equestrian use would be allowed under the Continuation of the Interim Use Trail Alternative. Fencing would prohibit horses from entering sensitive areas; therefore, direct impacts to wetlands due to equestrian use are unlikely. Horse manure has the potential to affect water quality in wetlands, streams, and Lake Sammamish by the addition of excess nutrients. The likelihood of this potential impact is low, as horses would be present in the area only for short durations and in low numbers. Importantly, vegetated wetlands, vegetated uplands, wetland buffers, and the ditches that parallel much of the trail serve to mitigate potential water quality impacts to streams and Lake Sammamish through nutrient retention and transformation processes.

4.4.3.2 *Impacts to Vegetation*

Vegetation management is a current and ongoing process in the operation of the Interim Use Trail. Under the Continuation of the Interim Use Trail Alternative, existing vegetation management practices would continue. During the permitting phase, the *Vegetation Management Plan* (Parametrix 2002c) would be updated to respond to changes introduced by this alternative (e.g., vegetation management requirements at new facilities), and would incorporate any special requirements of each applicable local jurisdiction and approved mitigation requirements.

4.4.3.3 *Impacts to Wetland-Associated Wildlife*

As stated earlier, wildlife use of wetlands and wetland buffers in the study area is limited because the available wildlife habitat is highly fragmented by urban development and the habitat quality is generally low. Wildlife species present are adapted to the urban environment and are tolerant of noise and the presence of humans and pets. The Continuation of the Interim Use Trail Alternative is not likely to affect wildlife because habitat conditions would remain largely unchanged.

4.4.3.4 *Impacts to Wetland Buffers*

Under the Continuation of the Interim Use Trail Alternative, no additional direct permanent or temporary impacts to buffers would result from the trail or the proposed parking and restroom facilities because construction does not occur in or near wetlands. Indirect impacts to buffers would remain unchanged.

4.5 IMPACTS FROM THE CORRIDOR ALTERNATIVE

4.5.1 Direct Permanent Impacts

The following sections provide a discussion of the potential direct impacts to wetland area and function that could potentially result from the construction and operation of the Corridor Alternative. The information is organized by wetland HGM class (see Tables 4-2, 4-3, and 4-4). The total area of direct impacts under this alternative is estimated to be 1.04 acres.

4.5.1.1 Depressional Closed Wetlands

Of the two depressional closed wetlands in the study area, Wetland 18C is completely avoided by the Corridor Alternative, while Wetland 8C would have less than 0.01 acre of direct impact due to filling. This palustrine emergent (reed canarygrass) wetland is composed of a low swale located entirely within the King County right-of-way (see Appendices G and H for information on individual wetlands). Filling could cause minor losses of water storage capacity and eliminate reed canarygrass.

4.5.1.2 Slope Wetlands

Of the 16 slope wetlands in the study area, 11 are completely avoided by the Corridor Alternative (see Table 4-4). Approximately 0.20 acre of impact would occur to five wetlands.

The greatest impact area (0.12 acre) occurs in Wetland 4B/D, a wetland that extends from the King County right-of-way into Sammamish State Park. Fill would result in the removal of reed canarygrass and some patches of willow that occur along the rail embankment. The affected portion of this wetland currently functions to provide potential water quality improvements through nutrient and sediment retention and provides limited habitat for some urban-adapted wildlife species. Filling would eliminate these wetland functions from the affected portion of the wetland, but would not result in substantial impacts because the impact areas have been previously disturbed.

Impacts to Wetland 24B cover approximately 0.06 acre. This small wetland was identified as providing a moderate level of wildlife habitat functions because it contains two streams, open water, and is forested. However, impacts to the wetland occur adjacent to the Interim Use Trail in previously disturbed areas and do not directly impact the streams, a small pond, or forest habitat. In the impacted area, vegetation is composed of reed canarygrass and Himalayan blackberry, with a few red alder trees and wetland shrubs also present. The loss of this vegetation would result in a small decrease in habitat for urban-adapted wildlife but have little impact on the functions of the wetland as a whole.

For the remaining three areas of impact to slope wetlands, fill areas are equal to or less than about 0.01 acre and occur in previously disturbed areas. Minor losses of non-native vegetation (typically reed canarygrass) would occur. Minor losses of functions identified in Section 3.2 would occur, but these losses would not be expected to be substantial or measurable because of the small areas of impact and the low level of functions.

4.5.1.3 *Modified Slope Wetlands*

In the Corridor Alternative, the impacts to modified slope wetlands total 0.40 acre (see Table 4-4). Six of the 32 wetlands in this HGM class are completely avoided by the Corridor Alternative. Direct impacts would occur in small areas along the western edge of 26 wetlands, adjacent to the eastern side of the Interim Use Trail alignment. Wetlands 4F and 6B would be directly impacted by added fill in areas where the trail transitions to the parkway for park entrance and roadway crossings, respectively.

These wetlands function to detain small amounts of stormwater; impacts due to fill would reduce or eliminate this function from small areas. Wetlands 4E, 10C, 20A, 34B, and 34C/D have somewhat trough-shaped topography, and the water holding capacity of these areas would be reduced a small amount.

Wetland 4E is located between the Interim Use Trail and East Lake Sammamish Parkway. Impacts to this long, narrow wetland total approximately 0.10 acre, with most of the impacts occurring to areas vegetated with reed canarygrass. A reduction in vegetation in this and other modified slope wetlands could potentially result in minor impacts to other functions such as organic matter production, wildlife habitat, and organic matter export. In general, these impacts would not be substantial because impact areas are small, previously disturbed, and currently provide a low level of function.

4.5.1.4 *Modified Riverine Wetlands with Fish*

The 20 modified riverine wetlands in the project area generally occur between the Interim Use Trail alignment and the parkway (see Table 4-4). Wetland impacts to this HGM class total 0.36 acre for the Corridor Alternative and occur in 15 locations. Five wetlands are avoided. Wetlands in this class provide limited riparian habitat support, including shading and organic matter production. Impacts that reduce wetland area and vegetation would result in minor reductions in habitat support functions. The modified riverine wetlands also function to retain limited amounts of stormwater, and fill in these areas would cause minor reductions in this function. No fish habitat would be altered, and the minor changes described above would be unlikely to degrade fish habitat because areas where impacts occur are previously impacted, of low quality, and small.

4.5.1.5 *Modified Riverine Wetlands Without Fish*

In the Corridor Alternative, small impacts (about 0.01 acre) to seven modified riverine wetlands without fish total 0.08 acre (see Table 4-4). These impacts occur in previously disturbed areas and adjacent to the rail embankment. Fill in these areas could result in minor reductions in stormwater detention. Vegetation removal could result in minor reductions to organic matter export functions. Minor loss of low-quality reed canarygrass habitat would also occur.

4.5.2 Direct Temporary Impacts

4.5.2.1 *Vegetation Removal and Disturbance During Construction*

In limited areas, wetlands and vegetation could be disturbed during construction where an additional cleared area is required outside of the construction footprint. The impact could result from vehicle turning, materials laydown, or other minor construction activities. These impact areas are likely to be small, and impacts would be of short duration. This vegetation disturbance would be avoided or reduced by the use of BMPs, including clearly marking clearing limits, protecting wetland areas with fencing, identifying woody vegetation to be protected, and restoring vegetation in temporarily disturbed areas if necessary.

4.5.2.2 *Retaining Wall Construction*

Retaining walls may be required along some segments of the Corridor Alternative. Temporary indirect effects to wetlands could result during wall construction. In wetland areas, the depth of soil of sufficient bearing strength may be below the water table, and construction of wall footings could require temporary dewatering of the footing area. If dewatering were necessary, it would be short-term and limited in area. The limited duration and extent of dewatering would be unlikely to adversely alter ecological conditions in wetlands.

4.5.2.3 *Fence Installation*

Potential minor impacts to wetlands could result from fence installation adjacent to wetlands. Because split-rail or chain-link fences would be generally installed within the construction footprint or on existing fill, there would be little additional vegetation or soil disturbance. Minor impacts could result from sedimentation during installation of fence posts.

4.5.3 Indirect Impacts

4.5.3.1 *Impacts to Wetland Buffers*

Impacts to wetland buffers could result in indirect impacts to wetland functions if these impacts substantially alter the protective functions that buffers may provide. The buffer impacts of the Corridor Alternative are estimated to total 3.92 acres (see Table 4-5). Buffer impacts result from the removal of buffer vegetation in previously disturbed areas that are directly adjacent to the rail embankment. In many locations, buffer impacts are likely to occur along the slopes of the rail embankment, between the edge of the Interim Use Trail and the wetland edge. In most of these areas, vegetation is composed of reed canarygrass and Himalayan blackberry; there are no significant areas of native or high-quality vegetation that would be impacted. In many areas, the vegetation affected is mowed turf and ornamental shrubs.

Because these previously disturbed and modified buffer areas provide limited or no substantial functions related to wetland protection, the minor impacts to the buffers would not result in substantial loss or alterations of existing wetland functions. Indirect impacts of buffer alterations and loss are expected to be minor.

Table 4-5. Potential Wetland Buffer Impacts Summarized by Alternative

Wetland Buffer	Corridor Alternative (Acres)	East Alternatives (Acres)
10B	0.01	0.01
10C	0.05	0.05
12A	0.03	0.07
13A	0.50	0.20
14A, 14B, 14C	0.07	0.07
15A, 15B, 15C	0.06	0.00
18C	0.01	0.00
19A, 19B	0.05	0.00
1A, 4A, 4B, 4D, 4E, 4F, 4G	0.52	0.52
20A, 20B	0.04	0.00
21A, 21B	0.02	0.00
21C, 21D	0.04	0.00
22A/B	0.16	0.11
22C/D	0.06	0.10
23A, 23B	0.06	0.11
23C, 24A, 24B, 24C, 24D	0.20	0.29
25A, 25B, 25C, 25D, 25F	0.20	0.22
26A, 26C, 27A	0.30	0.31
28A[a]	0.03	0.03
29C	0.05	0.06
2A	0.02	0.02
30B	0.09	0.04
31D[a]	0.01	0.00
32A, 32B	0.16	0.16
33A	0.03	0.07
34A, 34B, 34C, 34D	0.47	0.47
34F	<0.01	0.01
34G	0.01	0.01
3A, 3B, 3C, 3D, 3E	0.15	0.33
5A, 5B	0.24	0.24
6A, 6B	0.06	0.06
7A, 8B	0.06	0.06
8A	0.12	0.12
9A, 9B, 10A	0.12	0.12
33H, 21C, 21D, EW	0.17	0.12
4D, 4E, 4F, 4G	0.05	0.04
Total	**3.92**	**4.05**

[a] Adjacent property owners have submitted information to the city of Sammamish indicating these areas are not wetland.

4.5.3.2 *Impacts to Water Quality and Quantity*

The Corridor Alternative will result in new impervious surfaces. While runoff from these surfaces could impact water quality and quantity in wetlands, substantial impacts are unlikely. With the exception of equestrian use, proposed trail uses would not generate surface pollutants that could enter into surface water; thus water quality impacts would not occur.

New stormwater facilities that reduce the impact of impervious surfaces on water quantity and quality would be required under the Corridor Alternative. However, these facilities will be designed and located to avoid direct wetland impacts to the greatest extent feasible and to mitigate potential adverse impacts of increased runoff. If necessary, any impacts to wetlands would be identified and evaluated during the design and permitting phase of the project.

Preliminary hydrologic analysis of the corridor with new impervious surfaces added under the Corridor Alternative has determined that the potential increase in water quantity would be small and that very small changes to the subbasin runoff characteristics would result (Parametrix 2004c). These very small changes are unlikely to alter the conditions or function of the wetlands in the project area.

Maintenance of Drainage Facilities

The existing drainage facilities are currently maintained under the operation of the Interim Use Trail to maintain the flow of water through the King County study area. This maintenance would continue. In some cases, replacement or repair of culverts would be needed under the Corridor Alternative, as identified in the *Water Resources Discipline Report* (Parametrix 2004c). BMPs (such as performing the work during the dry season and keeping disturbed areas to a minimum) would be used to reduce the risk of temporary sedimentation. Water diversions may be used when culvert replacement or other maintenance is needed in channels with flowing water. Water diversions are usually of short duration (up to several days) and performed according to Hydraulic Project Approval (HPA) conditions. Wetland impacts from water diversions would not be expected, but some wetland vegetation may be disturbed adjacent to repair locations.

Equestrian Use

Equestrian use would be allowed under the Continuation of the Interim Use Trail Alternative, and there are concerns that horse manure has the potential to affect water quality in wetlands, streams, and Lake Sammamish by the addition of excess nutrients. Fencing would prohibit horses from entering sensitive areas; therefore, direct impacts to wetlands due to equestrian use are unlikely. The likelihood of water quality degradation impact is low, as horses would be present in the area only for short durations and in low numbers. Importantly, vegetated wetlands, vegetated uplands, wetland buffers, and ditches that parallel much of the trail serve to mitigate potential water quality impacts to streams and Lake Sammamish through nutrient retention and transformation processes that these systems are known to provide.

4.5.3.3 *Impacts to Vegetation*

Vegetation Management

Vegetation management activities during trail operation under the Corridor Alternative would proceed largely as they have under the Interim Use Trail. However, the Corridor Alternative would result in vegetation management activities in additional areas where such practices were not previously required because of the increased width of the trail.

In forested wetlands located adjacent to the trail, vegetation management activities would be minor, and limited to trimming of trees and shrubs to maintain height and width clearance, removal of hazardous trees, and trimming to increase sight distance at some driveway crossings. Vegetation management in seven forested wetlands would be limited to areas less than 0.02 acre. Management activities in Wetlands 3B, 4A, 24A, 24B, and 26A could impact between 0.02 and 0.07 acre each. The impacted vegetation in all wetlands typically includes red alder and willow trees.

Vegetation management of shrub wetlands would include trimming of shrubs (typically willow) to provide width clearance and improve sight distances at some driveway crossings. Vegetation management could result in minor impacts to eight shrub-dominated wetlands. For most of these wetlands, the area of potential impact would be less than 0.01 acre. For Wetland 25C, the area of potential impact could be up to 0.02 acre.

Vegetation management impacts to up to 46 emergent wetlands would be minor under the Corridor Alternative and would include occasional mowing of vegetation. In the locations where management would occur, these wetland areas are generally vegetated with invasive plants (reed canarygrass and Himalayan blackberry), and thus substantial impacts to habitats and functions would not occur.

4.5.3.4 *Impacts to Wetland-Associated Wildlife*

As stated earlier, wildlife use of wetlands and wetland buffers in the study area is limited because the available wildlife habitat is highly fragmented by urban development, and the habitat quality is generally low because of extensive historical wetland modifications. The Corridor Alternative is not likely to affect wildlife because these habitat conditions would remain largely unchanged. Although more chain-link fence would be used along the corridor, compared to the Interim Use Trail, split-rail fencing would also continue to be used where possible to reduce human intrusion into wetlands, yet provide for wildlife movement. Thus the Corridor Alternative would only slightly increase existing levels of habitat fragmentation by further restricting wildlife movement to wetlands.

4.6 IMPACTS UNDER THE EAST ALTERNATIVES

The following sections provide a discussion of the potential direct and indirect impacts to wetland area and function that could potentially result from the construction and operation of the East Alternatives.

4.6.1 Direct Permanent Impacts

Direct permanent impacts to wetland area and function that could potentially result from the construction and operation of the East Alternatives are presented in Tables 4-2, 4-3, and 4-4. The total area of direct impacts to wetlands under the East Alternative is estimated to be 1.19 acres.

4.6.1.1 *Depressional Closed Wetlands*

Direct permanent impacts to depressional closed wetlands under the East Alternatives would be the same as those under the Corridor Alternative (see Table 4-4), because the proposed trail configuration adjacent to these two wetlands is the same under both build alternatives. These impacts are discussed in Section 4.4.1.1.

4.6.1.2 *Slope Wetlands*

Of the 16 slope wetlands in the study area, 13 are completely avoided by the East Alternatives (see Table 4-4), and impacts to most remaining wetlands in this HGM class are the same as those of the Corridor Alternative (Section 4.4.1.2). Impacts to Wetland 24B, 24D, and 4B/D under the Corridor and East Alternatives are identical; the total area of direct impacts to the three impacted wetlands under these alternatives is approximately 0.18 acre. Wetland 29B, impacted under the Corridor Alternative, would be avoided by the East Alternatives. Changes to wetland functions due to these impacts are largely the same as those of the Corridor Alternative (see Section 4.4.1.2).

4.6.1.3 *Modified Slope Wetlands*

Impacts to modified slope wetlands total 0.52 acre for the East Alternatives (see Table 4-4). Ten of the 32 wetlands in this HGM class are completely avoided by these alternatives. Wetlands 3C, 15C, 19A, 20A, and 21B, which are impacted under the Corridor Alternative, are completely avoided in the East Alternatives. Impacts to Wetlands 1A, 3E, 4E, 4F, 6A, 6B, 10C, 14A, 14C, 24C/D, 31C, 34B, and 34E are the same under both alternatives (see Section 4.4.1.3).

For most wetland areas in this HGM class, direct impacts would occur along the western edge of the wetland adjacent to the eastern side of the rail embankment. Wetlands 12A, 22A/B, 22C/D, and 23A would be impacted along the wetlands' eastern boundaries adjacent to the parkway. Impacts to Wetlands 3D, 4E, 4F, and 13A would occur where the East Alternatives transition to and from the King County right-of-way. Wetlands 12A and 23A are forested, and construction adjacent to the parkway could remove a portion of the forest canopy from these wetlands.

Changes to wetland functions due to impacts are largely the same as those of the Corridor Alternative (Section 4.4.1.3). However, while the East Alternatives' impacts to forested wetlands in this HGM class are somewhat larger (0.05 acre for the Corridor Alternative versus 0.09 acre for the East Alternatives), the change in acreage is small and unlikely to be ecologically significant. Potentially, a larger reduction in organic matter production could result, although, for all these alternatives, the total square footage of impacted area is low.

4.6.1.4 *Modified Riverine Wetlands With Fish*

The area impacted under the East Alternatives totals 0.42 acre. These impacts occur in 14 of the 20 wetlands in this HGM class; six wetlands are avoided. The East Alternatives completely avoid Wetlands 3A and 30B, wetlands that are impacted by the Corridor Alternative. Impacts to Wetland 3B are less under the East Alternatives (see Table 4-4 and Section 4.4.1.4). Impacts to Wetlands 24A, 24C, and 26A occur where the trail transitions between the King County right-of-way and the parkway.

Impacts to forested wetlands are about 0.05 acre greater under the East Alternatives than the Corridor Alternative (0.23 acre versus 0.29 acre). This change is small and unlikely to be ecologically significant. Thus impacts to wetland function would be similar to those of the Corridor Alternative.

4.6.1.5 *Modified Riverine Wetlands Without Fish*

The area of modified riverine wetlands without fish impacted under the East Alternatives totals 0.06 acre (see Table 4-4). Seven of the eight wetlands in this HGM class are potentially affected. Wetland 21D is impacted (0.02 acre) under the Corridor Alternative, but avoided under these alternatives. Wetland 25A is avoided under the Corridor Alternative, but impacted (less than 0.01 acre) under these alternatives.

Impacts to the other five wetlands are the same as in the Corridor Alternative. Impacts to wetland functions are the same as in the Corridor Alternative (see Section 4.4.1.5) because the small differences in wetland acreage affected are probably not ecologically significant.

4.6.1.6 *Impacts to Wetland Buffers*

4.6.2 Direct Temporary Impacts

Direct temporary impacts to wetlands and buffers under the East Alternatives would be largely the same as those in the Corridor Alternative (Section 4.4.1.6). These include potential temporary vegetation removal, construction noise and disturbance to wetland-associated wildlife, potential sedimentation during construction, and dewatering during retaining wall construction.

4.6.3 Indirect Impacts

The potential indirect impacts to wetlands from the East Alternatives would be similar to those discussed in the Corridor Alternative (Section 4.4.3).

4.6.3.1 *Impacts to Wetland Buffers*

Impacts to buffers under the East Alternatives would total approximately 4.21 acres (see Table 4-5). Buffer impacts occur adjacent to the Interim Use Trail alignment and in locations where the trail would transition from this alignment to the parkway. Because buffer areas affected are previously disturbed and lack high-quality vegetation, they provide limited protection to wetland functions, and the loss of these buffer areas would not substantially impact wetland functions.

4.7 CUMULATIVE IMPACTS

Implementation of the Master Plan Trail by King County would result in wetland and wetland buffer impacts. These potential impacts are considered in light of the cumulative impacts of past, present, and reasonably foreseeable future actions to wetlands and wetland buffers.

Cumulative impacts are defined by the Council on Environmental Quality (1997) and 40 CFR 1508.7 as:

> *…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions.*

Potential cumulative impacts to wetlands are addressed in this section.

4.7.1 Historical Wetland Impacts

A variety of historical and land use activities have eliminated or degraded most wetlands in the project area. These actions have caused direct and indirect reductions to wetland functions. The typical activities occurring in or near wetlands that have reduced the function and value of wetlands are land clearing, agriculture, filling or draining, and development impacts.

Clearing. Land clearing occurs as a result of timber harvesting, farming, or land development. While it most notably removes wildlife habitat, large-scale land clearing removes or reduces most other wetland functions. Clearing impacts have occurred in all wetlands in the project area and adjacent watersheds.

Agriculture. Agricultural activities maintain non-native vegetation and other disturbance factors on cleared lands that further reduce wetland functions. Wetland soils are frequently drained, which can eliminate wetlands. Farming activities can also result in water quality impacts to wetlands and streams. In the project area, portions of the large wetland located at Lake Sammamish State Park and Marymoor were affected by farming.

Fill. Filling of wetlands began with road building and construction of the former railbed. Filling for land development became increasingly prevalent as the area became urbanized. In the project area, a considerable amount of filling and fragmentation was due to road construction and residential development.

Buffer Disturbance. Many wetland buffers have experienced clearing and disturbance through timber harvest, agriculture, transportation developments, and other urban development. In some areas where agricultural areas have been abandoned, buffer vegetation has become reestablished. In other areas, native vegetation has been replace with landscaping.

Stormwater Discharge. Some wetlands have been used for stormwater management. More generally, development results in impervious surface that generates increased runoff and potential pollutant sources that can degrade streams and wetlands. Increased stormwater runoff, if not adequately managed, can impact the hydrology and water quality of wetlands. These impacts can alter vegetation and habitat conditions. For wetlands in the project area, most are likely to receive increased runoff from roads and other development. It appears that other activities (clearing, landscaping, ditching, culverting, etc.) exert greater impacts on wetland condition than runoff.

Sedimentation. The land use changes that have occurred typically result in increased sedimentation to wetlands. In particular, timber harvesting, agriculture, and land clearing for development can result in wetland sedimentation. Development of roads and associated drainage ditches increase the probability that sediments will be transported downstream to wetlands and other receiving bodies. However, under current land use regulations, little soil disturbance occurs without extensive erosion control measures. For some riparian wetlands, high sedimentation impacts may be a result of increased stormwater discharges.

Fragmentation. Fragmentation results when land use changes and development eliminate habitat and isolate various habitat areas in a manner that no longer allows wildlife to effectively use remaining habitats. Development has resulted in fragmentation and loss of habitat for wetland-dependant and other wildlife. The development of linear features such as roads and extensive residential development has severely fragmented wetlands and other habitat in the project area. As a result, only highly mobile and urban-adapted wildlife are able to use wetlands in the project area.

4.7.2 Future Impacts

A variety of future development actions are likely to occur in the project area that, without mitigation, could contribute to wetland impacts. Several known projects that may occur in the area are listed in Table 4-6; however, the larger region continues to urbanize, and undeveloped land is likely to continue to undergo residential and commercial development.

Table 4-6. Summary of Formally Proposed Projects Within the Cumulative Effects Study Area

Project	Jurisdiction	Proponent or Notes	Time Frame for Completion
Millennium Trolley	City of Issaquah	Private group	Unknown
New Through Route Under I-90	City of Issaquah	City of Issaquah	Under discussion
Connecting Arterial Roads Improvements	Cities of Issaquah, Redmond, and Sammamish	Various cities	Various
East Lake Sammamish Parkway Road Improvements	City of Sammamish	City of Sammamish; improvements to the East Lake Sammamish Parkway may include center turn lane, curbs, and gutters	2005 through 2010
Proposed New City Parks Within the Study Area	Cities of Redmond and Issaquah	Cities of Redmond and Issaquah	Various
New Trail Connections	Cities of Issaquah, Redmond, and Sammamish	Cities of Issaquah, Redmond, and Sammamish	Various
SR 520 Improvements	City of Redmond	Washington State Dept. of Transportation	Unknown
Continued Development in the Study Area and Watershed	Cities of Issaquah, Redmond, and Sammamish	Various	Ongoing

4.7.2.1 *Regulations Protecting Wetlands*

While potential wetland impacts associated with these projects (if any) are not known, several important regulations and development standards will help protect wetlands from impacts that may occur from future development actions. These regulations and standards help reduce the potential for significant cumulative impacts to wetlands to occur. These regulations and policies are outlined below.

Growth Management Act (GMA). In 1990, the Washington State Legislature found that "uncoordinated and unplanned growth, together with a lack of common goals… pose a threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state. It is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning." [RCW 36.70A.010] This is the foundation of the GMA. Under the GMA, Urban Growth Areas (UGAs) are designated (the study area is within a UGA). UGAs are areas where growth and higher densities are expected. Thus, for this cumulative impacts study, the time of the enactment of the GMA (in approximately 1991) has been chosen as the point from which historical information is evaluated.

Prior to the adoption of the GMA, small wetlands located in the watersheds had little if any land use protection and, wherever economically feasible, these wetlands were filled and drained to support agriculture or urban development. Since the early 1980s, wetland protection levels have increased, and now a variety of local, state, and federal laws are designed to prohibit nearly all activities in or near wetlands that may cause additional physical or ecological degradation. One of the stated goals of the GMA (RCW 36.70A.020) is to "Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water." The GMA requires that certain counties and cities designate and protect wetlands, frequently flooded areas, and other critical areas.

Clean Water Act, Section 404. The US Army Corps of Engineers regulates fill placement in waters of the U.S. and triggers a Section 401 review by Ecology to protect water quality. Revisions to the nationwide permits in 2002 placed low thresholds on routine wetland fill, and mitigation requirements generally require replacement of function and area. Individual permits for more substantial wetland alterations require extensive compensatory mitigation to replace function and area. Mitigation extending beyond the required mitigation area helps ensure that cumulative losses do not occur over time.

Critical Areas Protection. Critical area protection is included as part of the municipal code of each jurisdiction in the study area. These regulations protect, among other elements, wetlands and wetland buffers. Wetland regulations are summarized in Appendix J.

Hydraulic Project Approval (HPA). HPAs are required from the Washington Department of Fish and Wildlife for projects that use, disturb, obstruct, or change the natural flow or bed of any fresh water or salt water of the state. HPAs generally require mitigation adequate to compensate for project impacts to wetlands. These approvals may also be required for projects that do not occur in wetlands but that discharge stormwater runoff to them. Mitigation for these projects can require enhanced stormwater detention and water quality standards to preserve existing runoff patterns and water quality.

Shoreline Management Act (SMA). The SMA was enacted in 1971 to manage and protect the state's shorelines by regulating development in the shoreline areas. A major goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." [90.58 RCW] Shorelines often contain wetland and wetland buffers. The city of Redmond (20B.95), city of Sammamish, and city of Issaquah each have Shoreline Master Programs.

Stormwater Management Standards. Local stormwater management standards are designed to ensure that future developments collect, detain, and treat stormwater runoff from urban areas and prevent degradation of receiving waters, including wetlands.

4.7.3 Summary of Impacts

A summary of effects of development in the project area is provided in Table 4-7. While large changes in land use have occurred in the watersheds that have impacted wetlands and wetland buffers, the most substantial changes have occurred prior to implementation of the Interim Use Trail. These changes included clearing old-growth and second-growth forest and developing agricultural lands and, more recently, the development of these areas for residential, commercial, and transportation uses. Most of this early development occurred without environmental mitigation and has contributed to cumulative losses of wetland and wetland buffers.

The historical impacts to wetlands and wetland buffers in the watersheds are typical for urban areas in King County. The development of agriculture in the area routinely included the modification of wetlands and wetland buffers to improve land for crop production. Land development has included wetland filling, stream channel modification, watershed hydraulic modification, and wildlife habitat loss. Shorelines have been developed for recreation and residential uses. Loss of wetland buffers results in an overall decline in the functions of the wetlands and a reduction of habitat.

The proposed East Lake Sammamish Master Plan Trail project could impact up to 1.19 acres of wetland and about 4 acres of wetland buffer. Local critical areas ordinances and the Clean Water Act required replacement of wetland area and functions (see discussion above and mitigation planned in Section 5). These legal requirements and the planned mitigation will ensure that the small impacts to wetland area and function are replaced, and that this project does not contribute to cumulative impacts to wetlands or wetland functions.

Current and future development in the study area would comply with a variety of increasingly protective environmental regulations concerning wetlands and wetland buffers. These regulations and substantial mitigation requirements would reduce the potential of additional cumulative impacts.

Table 4-7. Summary of Potential Cumulative Impacts of the Proposed Project and Other Past, Present, and Reasonably Foreseeable Future Actions on Wetland Resources

Resource	Past Actions	Proposed Action			Other Present and Future Actions[a]
		Construction	Operation	Mitigation	
Wetland Area	Wetland losses have occurred as a result of farming, commercial, residential, and transportation developments.	Loss of up to 1.19 acres of wetland could occur.	None.	No net loss. Wetland mitigation at the King County mitigation bank provides replacement wetland area.	Public and private development projects are likely to occur. Federal and local policies are a no net loss of wetland area. Federal, state, and local regulations are increasingly protective of wetlands. Section 404 Nationwide Permits (NWPs) and Individual Permits require mitigation for impacts that are more than *de minimus*, typically exceeding area impacts.
Biological Wetland Functions	Losses to biological functions have occurred because of rail transportation, public, and private development. In addition to filling and draining wetlands, past development and land uses have reduced the natural vegetation in and near wetlands and affected wildlife habitats. Residential development has largely isolated the lakeshore habitats from other habitats. Roads and other development isolate wetlands and reduce their accessibility and habitat functions to wildlife. Development has affected the rates and quality of runoff, which has impacted aquatic habitat in some wetlands.	Construction will eliminate the limited biological functions found in up to 1.19 acres of wetland. Without mitigation, wetland loss and buffer impacts would cause a minor loss of habitat used by urban-adapted wildlife species.	Operation impacts to wetland habitat could include some disturbance to urban-adapted wildlife. Vegetation management could alter wetland vegetation in limited areas.	No net loss. Wetland mitigation at the King County mitigation bank provides replacement wetland habitat functions. The diversity of habitats and their protection from human uses results in biological functions that exceed those of the impacted wetlands.	Federal and local policies are a no net loss of wetland functions. Federal, state, and local regulations are increasingly protective of wetlands. Section 404 NWPs and Individual Permits require mitigation for impacts that exceed the *de minimus* level. Mitigation areas typically exceed the impact area. Mitigation planning increasingly focuses on replacing and enhancing biological functions. Local regulations protect wetland buffers.

Table 4-7. Summary of Potential Cumulative Impacts of the Proposed Project and Other Past, Present, and Reasonably Foreseeable Future Actions on Wetland Resources (continued)

Resource	Past Actions	Proposed Action			Other Present and Future Actions[a]
		Construction	Operation	Mitigation	
Physical Wetland Functions	Filling of wetlands has likely eliminated the flood storage, water quality, and groundwater exchange functions they provided. Past public and private developments and land uses have reduced the vegetation in and near remaining wetlands, which may also reduce water quality and other functions the wetlands once provided.	Construction will eliminate the limited physical functions found in up to 1.19 acres of wetland. Without mitigation, wetland loss and buffer impacts would cause losses of limited water quality and water storage functions.	Without mitigation, minor operational impacts to physical wetland functions could include decreased water quality and stormwater storage functions.	No net loss. Wetland mitigation at the King County mitigation bank provides replacement wetland habitat functions. The diversity of habitats and their protection from human uses results in biological functions that exceed those of the impacted wetlands.	Future projects would likely impact wetlands in a manner that could eliminate or reduce wetland functions. Mitigation planning increasingly focuses on replacing and enhancing biological and physical functions provided by wetlands, which requires wetland protection, enhancement, or other mitigation. Local regulations protect wetlands and require mitigation of impacts to wetlands in most circumstances.
Wetland Buffers	Previous farming, commercial, residential, and transportation developments have eliminated or reduced the function of wetland buffers.	Loss of up to 4.1 acres of wetland buffer could occur.	Without mitigation, vegetation management would cause minor alterations of vegetation in wetland buffers.	Where feasible, buffer enhancement actions and off-site mitigation could mitigate buffer impacts.	Future projects would likely impact wetland buffers in a manner that could eliminate or reduce wetland functions. Mitigation planning increasingly focuses on replacing and enhancing biological and physical functions provided by wetlands and their. Mitigation r\frequently requires buffer protection, enhancement, or other mitigation. Local regulations protect wetland buffers and require mitigation in many circumstances.

[a] Evaluated with mitigation that would be required to meet federal, state, and local regulations.

5. CONCEPTUAL MITIGATION PLAN

Wetland and buffer impacts of the East Lake Sammamish Master Plan Trail are reduced or eliminated through a variety of mitigation actions. These mitigation measures are described in this section.

5.1 SEQUENCING

The Master Plan Trail project would avoid and minimize impacts to wetlands by proceeding in accordance with the mitigation sequencing requirements established by NEPA, the Clean Water Act, and other wetland protection programs. According to NEPA (40 CFR paragraphs 1508.20), the definition of mitigation is as follows:

1. Avoiding the impact altogether by not taking a certain action or parts of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
5. Compensating for the impact by replacing or providing substitute resources or environments.

In the following sections, strategies to avoid and minimize wetland and buffer impacts are discussed, and a plan to compensate for minimized unavoidable impacts is presented.

5.2 AVOIDANCE AND MINIMIZATION STRATEGIES

Consistent with the above sequencing requirements, a high priority was placed on avoiding and minimizing wetland and buffer impacts. Many of the strategies discussed below have already been incorporated into the alignments depicted in Appendix A and Appendix B, as well as the project description. For example, retaining walls are already proposed in many places, and the alignments have been located to reduce fill. Of the approximately 15 acres of wetlands in the study area, most are avoided, with direct wetland impacts of 0 to 1.19 acres, depending on the project alternative. All wetlands would be avoided by the Continuation of the Interim Use Trail Alternative.

King County would continue to apply the following strategies to minimize wetland and buffer impacts during the design, permitting, and construction phases::

- Use retaining walls to narrow the trail section where wetlands are crossed.
- Shift alignments away from wetland areas.
- Decrease the turning radii for transitions from the King County right-of-way to East Lake Sammamish Parkway.
- Near wetlands and streams, limit earthwork to the dry season to reduce the potential for sediment runoff.
- Use erosion control best management practices (BMPs) to reduce direct and indirect impacts of construction.

Some of the strategies that could be used to avoid or reduce direct impacts under the Corridor or East Alternatives are discussed in greater detail below. The feasibility of these suggested strategies would be evaluated further, in light of the project's purpose and need, there overall practicability, and other design constraints during the design and permitting phase of the project.

Reducing Trail Widths. In some locations, it may be possible to completely avoid or minimize wetland and buffer impacts by reducing the width of the trail through use of a narrower cross section or by incorporating retaining walls into the design. Standard fill slopes for the sides of the trail are designed with a ratio of two horizontal to one vertical, and achieving this slope sometimes results in wide areas of fill. Constructing retaining walls would narrow and thereby minimize the area of fill. In some locations, the use of a narrower cross section would avoid or minimize wetland and buffer impacts. Specifically, a narrower configuration could be considered at locations along the Corridor Alternative alignment where wider shoulders or a separated soft-surface trail are provided.

Shifting Alignments. The planned centerline of the Corridor Alternative varies from the centerline of the Interim Use Trail, in part to avoid and minimize impacts to sensitive areas. Similarly, the alignment of the East Alternatives, when moving between the King County right-of-way and the adjacent roadways, is planned to avoid and minimize impacts to wetland areas. During detail design, additional opportunities to reduce impacts would be considered.

Reducing Turning Radii for Transitions. Currently, AASHTO standards for turning radii are used to guide design of transitions to and from East Lake Sammamish Parkway, assuming a posted trail speed limit of 15 miles per hour. Some of these transitions would result in wetland and buffer impacts. Potentially, the turning radii for these transitions could be changed to a configuration closer to a right (90 degree) turn and following existing roads or driveways. This configuration would reduce or potentially eliminate the wetland or buffer impacts at some locations. However, trail user safety on these tight turns, particularly if on a down slope, could be a concern; therefore this approach would be evaluated more fully during future project phases in light of this and other potential constraints.

Reducing Potential for Human and Pet Intrusion. Fencing and signage can discourage intrusion by humans and pets into wetlands and buffers and would reduce the likelihood of vegetation or other human impacts. Regulations for trail use would require pets to be leashed. Fencing is already in place for the Interim Use Trail to provide this protection to wetlands, and similar fencing would be used to reduce potential impacts of the Corridor Alternative and the East Alternatives.

Utilizing Construction Best Management Practices. BMPs would be employed during trail construction, maintenance, and operation to minimize temporary impacts to wetlands and buffers. The following BMPs are recommended during construction:

- Use highly visible temporary construction fencing to delineate sensitive areas and vegetation and avoid accidental intrusion.
- Design, implement, and maintain temporary erosion and sediment controls to eliminate or minimize potential effects from sedimentation.
- Preserve and protect native plant species when installing fence lines, signage, and other features.
- Re-vegetate temporarily disturbed areas with appropriate species.

The **Vegetation Management Plan** provides details regarding the management and replacement of vegetation in wetlands and buffers during operation of the trail. This plan provides for BMPs that minimize impacts and specifies replacement of impacted vegetation.

5.3 COMPENSATION FOR UNAVOIDABLE WETLAND IMPACTS

The project currently proposes to compensate for any unavoidable wetland and buffer impacts primarily through the purchase of wetland banking credits from the King County Certified Wetland Mitigation Bank. This mitigation bank, which is administered by King County Department of Natural Resources and Parks (DNRP), is located east of the project corridor near the headwaters of Laughing Jacobs Creek in the city of Sammamish (near SE 32nd Street and 224th Avenue SE). Additional description is provided in Section 5.4 below. The mitigation bank was established specifically for linear transportation projects. The Master Plan Trail is within the mitigation bank's service area and DNRP has determined that bank credits are currently available for release.

If King County uses the wetland mitigation bank instead of on-site mitigation areas, greater ecological benefits would result because:

- The wetland mitigation is more likely to be successful.
- The ecological functions of the replacement wetland could be established more quickly and are likely to be higher than could be achieved in the corridor.
- The mitigation bank wetland is closer to relatively large areas of undeveloped land and to other wetlands with higher wetland functions.

The mitigation bank approach ensures that the functions of the wetlands affected by the selected alternative are replaced at a higher level of function at a site that is ecologically sustainable over time. The banking approach also ensures that appropriate compensatory mitigation is in place prior to unavoidable loss of wetland and buffer area and functions, thus reducing temporal losses of wetland functions. Importantly, the King County Mitigation Bank is currently functioning at a level that exceeds the level of wetland function at all of the potentially impacted wetlands in the study area. The larger off-site location at the mitigation bank provides greater ecological benefits than small on-site locations would provide. In general, for the wetland functions affected by the project alternatives, off-site mitigation in the Lake Sammamish Watershed could provide appropriate replacement functions to meet regulatory requirements for mitigation without resulting in substantial on-site impacts to wildlife, fish, or water resources in the project corridor along Lake Sammamish.

The detailed consideration and the calculation of appropriate bank credits would be performed in the project permitting and design phase in concert with federal, state, and local permitting agencies. Ultimately, the mitigation banking approach must be approved by federal, state, and local jurisdictions.

If it is determined that mitigation should not occur in the mitigation bank, on-site mitigation opportunities would be used. This approach would focus on replacing wetland and buffer impacts in the existing King County right of way and/or nearby areas. The mitigation would likely include establishing new wetland, enhancing and restoring wetlands, and enhancing wetland or stream buffers. Such an approach would replace impacts to wetland areas and functions, but because of the urban setting, ecological functions of the mitigation may not substantially exceed the low levels of functions provided by the impacted wetland and buffer areas.

5.4 THE KING COUNTY MITIGATION BANK

The King County mitigation bank includes enhanced, created, and natural wetland areas. The site is located east of the project area near the headwaters of Laughing Jacobs Creek. Historically, a portion of the wetland was used as pasture prior to purchase and restoration by King County. The site now consists of open water and emergent, shrub, and forested wetland types.

The deciduous forest species present include red alder and black cottonwood saplings. Conifers include Sitka spruce (*Picea sitchensis*) and red cedar saplings. Clumps of dense alder are present in one area. Dense shrub areas are common and include Pacific willow, snowberry (*Symphoricarpos albus*), salmonberry, and red osier dogwood with a few black cottonwood trees. A thick growth of Douglas spirea occurs in one area. Upland buffers and transitional areas have a mixture of evergreen trees that include Douglas-fir and western hemlock with an understory of roses (*Rosa* spp.), hazelnut (*Corylus cornuta*), salmonberry, red osier dogwood, and Pacific ninebark. Near the open water, soft rush, grasses, and cattail dominate the emergent wetland.

5.5 MITIGATION AREA NEEDS

The estimated area of compensatory mitigation needed to mitigate wetland impacts according to required or recommended replacement ratios for Ecology (Ecology 1993) or the wetland's local jurisdiction (City of Issaquah 18.10.590D {City of Issaquah 1997}, City of Sammamish 21A.15.1415 {City of Sammamish 1999}, City of Redmond {20D.140.10-250, 1997}) are shown in Tables 5-1 and 5-2. The compensatory mitigation area for the Corridor Alternative is estimated to be 1.5 acres using the local jurisdiction ratios and 2.96 acres using Ecology's mitigation ratios. Ecology's (1993) mitigation ratios are consistent with the mitigation ratios recommended in the 1993 Wetlands Implementing Agreement between WSDOT and Ecology (WSDOT Environmental Procedures Manual) Mitigation ratios are shown in Table 5-3. For the East Alternatives, 1.84 acres of mitigation is needed according to local ratios and 3.36 acres would likely be needed to meet Ecology's requirements.

Table 5-1. Mitigation Area Needed According to Local Jurisdiction Compensation Ratios for the Corridor Alternative and East Alternatives

Local Wetland Rating (Class or Category)	Issaquah (Acres)	Sammamish (Acres)	Redmond (Acres)	Total (Acres)
Corridor Alternative				
1	0.24			0.24
2	0.35	0.51		0.86
3	0.26	0.13		0.39
I			0.00	0.00
III			0.04	0.04
Not Rated	0.00	0.05	0.00	0.05
Total	**0.86**	**0.69**	**0.04**	**1.58**
East Alternatives				
1	0.24			0.24
2	0.31	0.75		1.06
3	0.26	0.13		0.39
I			0.00	0.00
III			0.04	0.04
Not Rated	0.00	0.10	0.00	0.10
Total	**0.82**	**0.98**	**0.04**	**1.84**

Table 5-2. Mitigation Area Needed According to Ecology Compensation Ratios for the Corridor Alternative and East Alternatives

Ecology Wetland Rating	Issaquah (Acres)	Sammamish (Acres)	Redmond (Acres)	Total (Acres)
Corridor Alternative				
I	0.73		0.00	0.73
II		0.17		0.17
III	1.05	0.93	0.07	2.06
Total	**1.78**	**1.11**	**0.07**	**2.96**
East Alternatives				
I	0.73		0.00	0.73
II		0.17		0.17
III	0.99	1.40	0.07	2.47
Total	**1.72**	**1.57**	**0.07**	**3.36**

Table 5-3. Compensatory Mitigation Ratios use to Estimate Mitigation Needs, by State and Local Jurisdictions

Ecology Wetland Rating	Ecology (1993)/WSDOT EPM	Sammamish	Redmond	Issaquah
I	6:1 to 4:1	Cat. 1 and 2 – 2:1	6:1 to 2:1	Class 1 – 2:1
II	3:1 to 2:1		2:1 to 1:1	Class 2 – 2:1
III	2:1 to 1:1	Cat. 3 – 1:1	2:1 to 1:1	Class 3 – 1:1
IV	0.75:1 to 1.5:1			

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APPENDIX A

Corridor Alternative Design Maps

The figures for Appendix A are located in Volume II of the
Draft Environmental Impact Statement (October 2006)

APPENDIX B

East Alternative Design Maps

The figures for Appendix B are located in Volume II of the Draft Environmental Impact Statement (October 2006)

APPENDIX C

Appendix C-1
Appendix C-2
Trail Cross Sections

APPENDIX D

National Wetlands Inventory Map of the Study Areas

APPENDIX E

Soil Survey Map of the Study Area

APPENDIX F

Plant and Animal Species in the Study Area

APPENDIX G

Wetland Data Sheets

APPENDIX H

Individual Wetland Descriptions

APPENDIX I

Ecology Wetland Rating System Summary Table

APPENDIX J

Wetland Regulatory Information

APPENDIX K

WSDOT Functional Assessment Table

APPENDIX L

Agency Correspondence